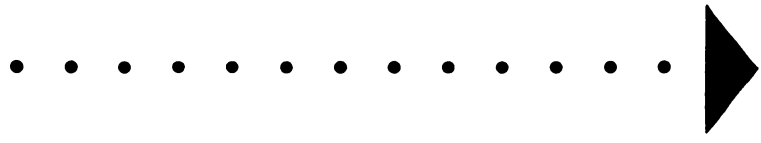
HOW TO CONSTRUCT & MAINTAIN YOUR TELEPHONE LINE

With the compliments of the Postmaster-General's Departme



COMMONWEALTH  OF AUSTRALIA

HOW TO CONSTRUCT AND MAINTAIN YOUR TELEPHONE LINE

WITH THE COMPLIMENTS OF THE

AUSTRALIAN POST OFFICE

FOREWORD

This booklet has been prepared to assist those persons who are required to erect and maintain a portion of their telephone line towards obtaining a more efficient and reliable telephone service.

It describes, step by step, the correct method of constructing the private portion of a telephone line and maintaining it in good order.

In many respects a telephone line is similar to a fence. If sound workmanship and good materials are used in construction, both will give good service for many years. If a fence is not kept in good condition by regular maintenance the stock will stray—if a telephone line is not properly maintained the electricity will stray and the conversation will be lost. The three essential factors in obtaining a satisfactory telephone service are, therefore, SOUND WORKMANSHIP, GOOD MATERIALS and REGULAR MAINTENANCE. If these principles are adhered to, the telephone line will become a valuable and lasting asset.

Should you desire further information regarding any point in the installation or maintenance of a part privately erected telephone service, do not hesitate to seek advice from technical staff of the Post Office. It will be given gladly, free of charge.

CONTENTS

	PAGE
FOREWORD	5
How to Plan Your Telephone Line	9
Type of circuit	9
Determining the most suitable route	10
Type of construction	11
Supply of material	12
Twelve Stages in Building a Telephone Line	13
How to Construct a Pole Line	15
Clearing route	15
Erecting poles	15
Staying poles	21
Fittings for attaching wires to poles	24
Erecting wires	26
Jointing wires	31
Terminating wires	33
Attaching wires to insulators	35
Installing transpositions	36
Attaching wires to buildings	38
Installing earth wires	38
How to Construct a Scantling Line	40
How to Construct a Tree Line	41
Inspecting the Completed Line	44
Installing the Telephone	44
How to Keep Your Telephone Line in Good Order	44
Checking the Line—Step by Step	45
How to Maintain Wooden Poles	55
How to Clear Faults on Your Service	57

HOW TO PLAN YOUR TELEPHONE LINE

Like any other major project, the construction of a telephone line requires careful planning to obtain the best results. Good planning will save you time, work and unnecessary expense and ensure that your line is constructed to a standard which will give a high grade of service and low maintenance cost. Matters which will require consideration are the type of circuit (double or single wire), the most suitable route for the line, the type of construction (pole line, scantling line or tree line), and the supply of material.

Type of Circuit.

Telephone lines may be of two types, double wire (metallic circuit) lines, and single wire (earth circuit) lines.

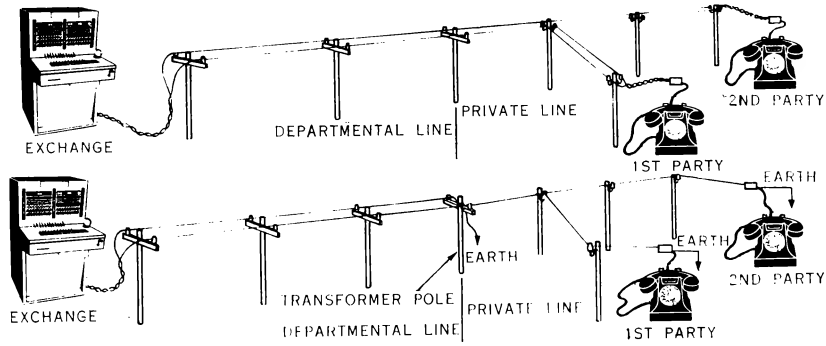
Double wire lines provide the most efficient service, with freedom from electrical interference such as crosstalk or noise from nearby telephone or power lines.

Single wire lines, though cheaper to construct than double wire lines, give a lower grade of service. They are very susceptible to electrical interference and will not operate satisfactorily if erected near a high voltage power line. Generally a certain amount of noise is always prevalent on this type of circuit and, under certain conditions, for example on long lines in hot weather, the noise will be great enough to interfere with conversations. For these reasons it is usually in your best interests to construct a double wire line.

Where the service will be connected to an automatic exchange single wire lines are to be avoided, if possible, and will not be allowed if more than one telephone is to be connected to the line.

All telephone lines constructed by the Post Office are double wire and at the point where a single wire line joins a Post Office double wire line the connection is made through a piece of electrical apparatus termed a "transformer". Transformers are supplied, installed and maintained by the Post Office and an annual rental is charged. Where a portion of the privately constructed line is double wire and the balance single wire, transformers must be used and may be purchased from the Post Office.

Double Wire Party Line.



Single Wire Party Line.

Determining the Most Suitable Route.

Select the most direct route between your residence and the point where your telephone line will join the Post Office pole route. Bear in mind the desirability of being able to drive or ride close to the line for the transport of material for construction and repairs and for the location of faults.

Make the route as straight as possible with the minimum number of angles. Avoid locations where the ground is swampy or subject to flooding and where heavy clearing of timber will be necessary.

If the line is to be erected on private property other than your own, obtain written permission from the owner of the property. Keep the line clear of cultivations and other locations where there is a possibility of damage to the wire from fire when burning off trash, stubble, etc. A position on the fence line or 3 feet from the fence is generally most suitable for the poles.

Where the line will extend along public roads or cross roads, railway tracks or navigable waterways, the position of the line and type of construction must conform to the requirements of the Shire or Town Council, Roads Board or Railway Department. Permission in writing must be obtained before the line is erected. The Authority concerned will, in some cases, specify the alignment for the pole route but where this is not done a position approximately 3 feet outside the fence line should be adopted where practicable. The pole route must occupy the same side of the road throughout to avoid subsequent alterations if the road is used in future as the route of a power line.

Where several telephones are to be connected it is not necessary to run the main line past each building, as short branch lines can be run from the main line in order to save wire and simplify construction.

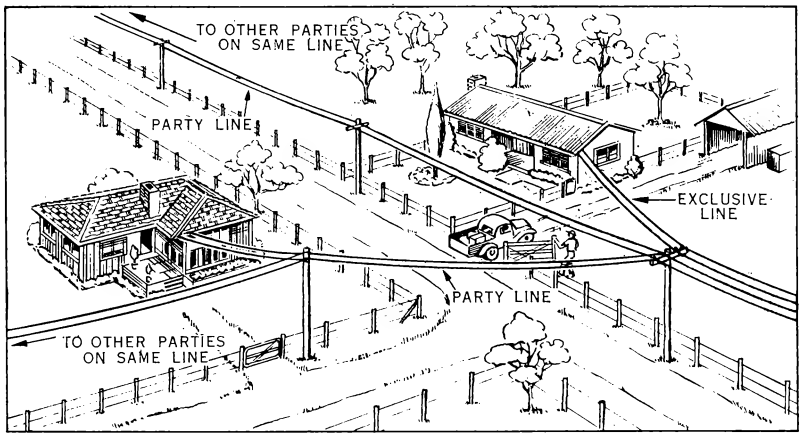
Select a route which will be as far away as practicable from any existing or future high voltage power line. Enquire from your local Power Authority as to the route proposed for any high voltage

power line extensions in your district. It is emphasized that in the event of excessive electrical interference to your telephone line, it is your responsibility to modify or shift your line to eliminate this trouble.

Single wire lines are very susceptible to noise caused by power lines and where the route of the line will parallel a high voltage power line for 2 miles or more, you should endeavour to maintain a separation of at least a $\frac{1}{4}$ mile between the two routes. If this separation cannot be obtained, it may be necessary to provide a double wire line over portion or all of the circuit.

Where telephone lines are erected parallel for any distance, especially if close together, interference commonly known as "crosstalk" will result, that is, one subscriber will be able to hear in his telephone receiver the conversations on the other line or lines. A single wire circuit should be separated from all other single wire circuits by at least 1 chain and if the parallel extends beyond 2 miles, the separating distance should, as far as possible, be correspondingly increased as the length of the parallel increases. Metallic circuit or double wire lines can, however, be erected on the same poles or on separate pole routes closely adjacent for very long distances. Crosstalk is eliminated by transposing the wires, that is, reversing the position of the two wires on the poles at regular intervals.

The proposed route will be inspected by Post Office technical staff where necessary to ensure that the location selected for the line will be least subject to interference from other telephone lines or power lines.



Branch Line Leading off Main Pole Route.

Type of Construction.

Supports for Wires.

The selection of supports for the wires is a matter which is determined largely by local circumstances. The purpose of the supports is, first, to keep the wire off the ground or from contacting

other wires, trees, undergrowth, long grass, etc., which would divert the electric current from its proper path and, secondly, to keep the wire from being damaged by or injuring pedestrians, stock or traffic. Poles, hardwood scantlings or trees may be used.

Poles are the best supports as they enable a higher standard of construction to be obtained, giving more efficient service and lower maintenance cost. The heavier the gauge of wire used, the more substantial the supports should be. In districts where sound, durable timber is not available or where white ants are particularly prevalent, iron poles such as old railway rails or galvanized iron piping are preferable.

Where lines are erected along fences, hardwood scantlings not less than 3 in. x 2 in. bolted to fence posts may be used instead of poles. This type of construction is only suitable for one pair of wires using spans not greater than 2 chains with wires at 8-ft. clearance from the ground. Where more wires or greater clearances are required, more substantial construction is necessary.

Tree lines are satisfactory for lines which pass through timbered country. The trees to which the wires are attached must be substantial; light timber which has considerable movement in the wind is unsuitable. The wire must be no lighter than 200 lb. per mile galvanized iron or 237 lb. per mile cadmium copper.

Type of Wire.

The gauge and type of wire to be used depends on the length of the line and the type of construction. The Post Office will advise you of the most suitable wire for your service.

Galvanized iron wire is usually used for privately constructed lines because of its relatively low cost, strength, and ease of handling as compared with copper or cadmium copper wires. Galvanized iron wire 200 lb. per mile (approximately No. 11 gauge) as used by the Post Office has the most general application but in cases of long lines or locations exposed to high winds 400 lb. per mile (approximately No. 7 gauge) G.I. wire may be necessary.

Whilst iron wire is cheaper than copper wire, its electrical efficiency for transmitting speech is very much inferior, for example, 70-lb. cadmium copper wire is much more efficient than 400-lb. galvanized iron wire. In cases where the length of line is such that a satisfactory standard of service cannot be obtained with galvanized iron wire, it will be necessary to use copper wire.

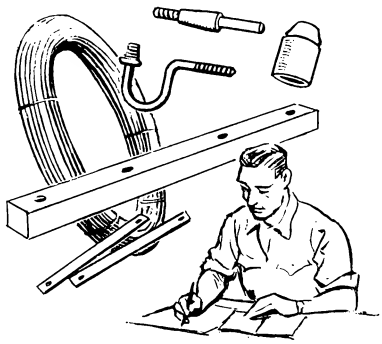
Supply of Material.

To assist you to construct your private line to Post Office standards, you will be advised of the approximate quantities and type of line material required.

All items of material with the exception of poles may be purchased from the Post Office subject to supplies being available. Where material is obtained from other sources, only the best quality should be purchased.

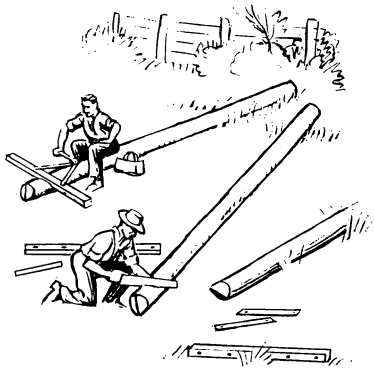
TWELVE STAGES IN BUILDING A TELEPHONE LINE.

1 MEASURE ROUTE
AND PEG POSITIONS FOR POLES

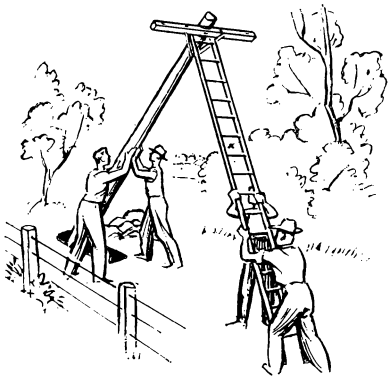


2. ORDER MATERIALS

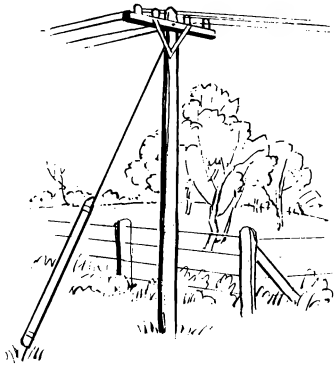
3. CLEAR TIMBER FROM ROUTE



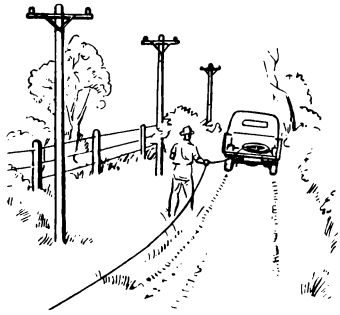
4. ATTACH FITTINGS TO POLES



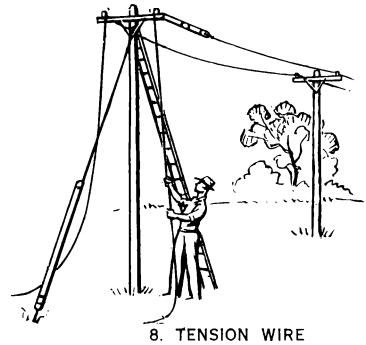
5 ERECT POLES



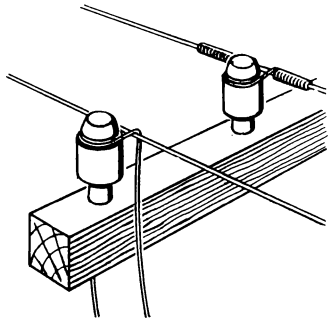
6 FIT STAYS TO POLES



7 RUN OUT WIRE

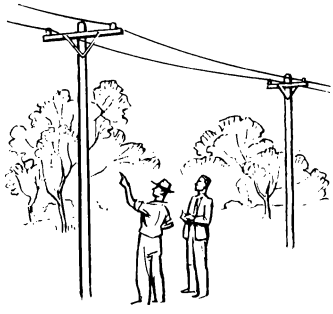


8. TENSION WIRE



9 ATTACH WIRES TO INSULATORS

10. ADVISE DEPARTMENT LINE IS COMPLETED



11 ACCOMPANY DEPARTMENTAL OFFICER ON INSPECTION OF LINE

12. ASSIST DEPARTMENTAL OFFICER TO INSTALL TELEPHONE

HOW TO CONSTRUCT A POLE LINE

CLEARING ROUTE.

Clear timber and undergrowth for at least 10 feet on both sides of the route so that there will be no risk of limbs or leaves touching the line wires. Beyond this distance avoid leaving limbs of trees which are likely to fall and foul lines or stay wires.

Before commencing clearing, obtain the approval of the controlling Authority (either Shire Council or Main or Country Roads Board) where the trees to be cut are on a public road, or the landowner where the trees are on private property.

ERECTING POLES.

Wooden Poles.

Select poles which are straight, sound, well-proportioned and of a class of timber which is durable above and in the ground. Use a timber which is known to have good lasting qualities in your district. If you are in doubt as to the most suitable timber, seek the advice of the local Post Office Line Foreman or the Electricity Authority Foreman.

The use of good class pole timbers will save much inconvenience and heavy cost for the pole renewals in the future.

MINIMUM DIMENSIONS OF WOODEN POLES.

Length of Pole.	Minimum Diameter, Including Sapwood.	
	At Top.	At Base.
feet.	inches.	inches.
12	5	7
14	5	7
16	5	7½
18	5	8
20	5	8½
22	5	9½
24	5	9¾
26	5½	10
28	5½	10
30	5½	10

Where the sapwood is more than 1 inch thick the diameter of the poles should be correspondingly increased.

From the aspect of stability and future maintenance, slightly heavier poles are considered desirable, particularly where more than four wires are to be erected.

In localities where timber to this specification cannot be procured, and you are contemplating using lighter poles, seek the advice of the Post Office and give full details of the type of timber and the average dimensions of the poles that are available.

Iron Poles.

Iron poles are particularly suited to areas where good wooden poles cannot be obtained or where damage by termites is prevalent. The most suitable types are galvanized iron water piping, old railway rails and steel beams. The initial cost of this material is usually higher than for wooden poles but maintenance costs are correspondingly reduced.

Special fittings for attaching crossarms to iron poles may be purchased from the Post Office.

MINIMUM SIZE G.I. PIPE FOR USE AS POLES.

Number of Wires.	Clearance of Wires from Ground.	Internal Diameter of Piping.
	feet.	inches.
1	8	1
4	8	2
8	8	2½
1	12–18	1½
4	12–18	2½
8	12–18	3

Distance Between Poles.

The length of the span between poles is dependent upon the type of wire used and the size of poles. Lines constructed of light-gauge wire or very light poles will require much shorter distances between the poles than heavier type construction.

NORMAL AND MAXIMUM SPAN LENGTHS.

Class of Wire.	Normal Span Length.	Maximum Span Length.
	yards.	yards.
40 lb. cadmium copper ..	45–65	90
100 lb. hard-drawn copper	45–65	90
200 lb. galvanized iron ..	65–90	110
400 lb. galvanized iron ..	65–90	110
70 lb. cadmium copper ..	65–90	110
200 lb. hard-drawn copper	65-90	110

Length of Poles.

Poles must be of sufficient length to enable the wires to be erected at a height which will not endanger traffic or stock. The minimum clearances for wires along and across roadways or railways shown in the table below are required by law and must not be reduced.

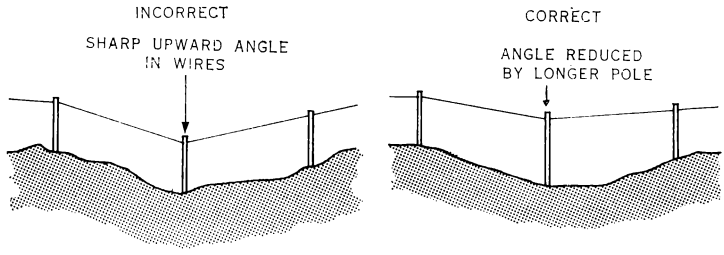
MINIMUM LENGTHS OF POLES REQUIRED FOR ONE WIRE OR ONE CROSSARM.

Location.	Minimum Height of Lowest Point of Wire.	Minimum Length of Pole Required.		
		Spacing Between Poles.		
		65 yards.	90 yards.	110 yards.
	ft.	ft.	ft.	ft.
Across private property—poles not more than 3 feet from fence line ..	8	14	16	18
Across private property—poles more than 3 feet from fence line ..	12	18	20	22
Along roadway—poles not more than 3 feet from fence line	8	14	16	18
Along roadway—poles more than 3 feet from fence line	12	18	20	22
Across roadway or gateway used by vehicles of high loading	18	24	26	28
Across railway lines	22	28	30	32

NOTE:—Where more than one wire or one crossarm is to be erected, increase the length of the pole by 1 ft. 2 in. for each additional swan-neck spindle or crossarm fitted.

Grading Pole Heights.

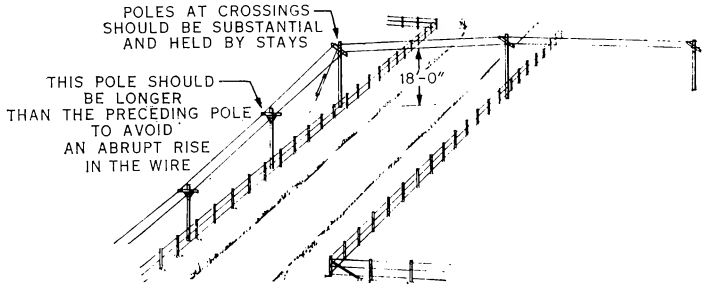
Sharp upward or downward angles in the route impose excessive strain on binding wires, insulators, and spindles and result in wire breakages. Where the angle is very severe, erect a longer pole.



Method of Reducing Upward Pull on Wires by Erecting Longer Pole in Valley.

Poles at Road Crossings.

Provide poles of sufficient height to give a minimum clearance of 18 feet between the wires at their lowest point and the crown of the road where the line crosses any public road.



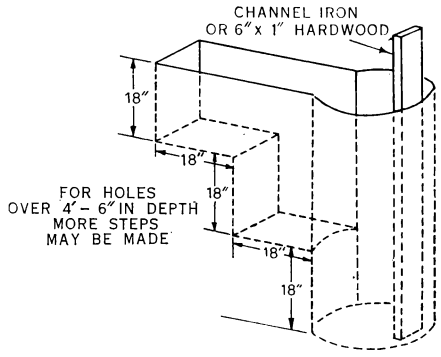
Method of Crossing Road.

Excavating Pole Holes.

The method of excavating holes by hand is shown on page 19. Dig the holes so that the steps are in line with the route, except at angles where the steps should face towards the stay. This will allow the pole to bear against firm earth.

When erecting a pole, place a length of timber at the back of the hole to assist the pole to slide into the bottom of the hole. Remove the timber when the pole is upright.

Fill in around the pole and ram the soil thoroughly. Do not attempt to climb the pole until this has been carried out and the pole is perfectly stable.



Typical 4 ft. 6 in. Stepped Hole for Wooden Pole.

DEPTH FOR SETTING POLES.

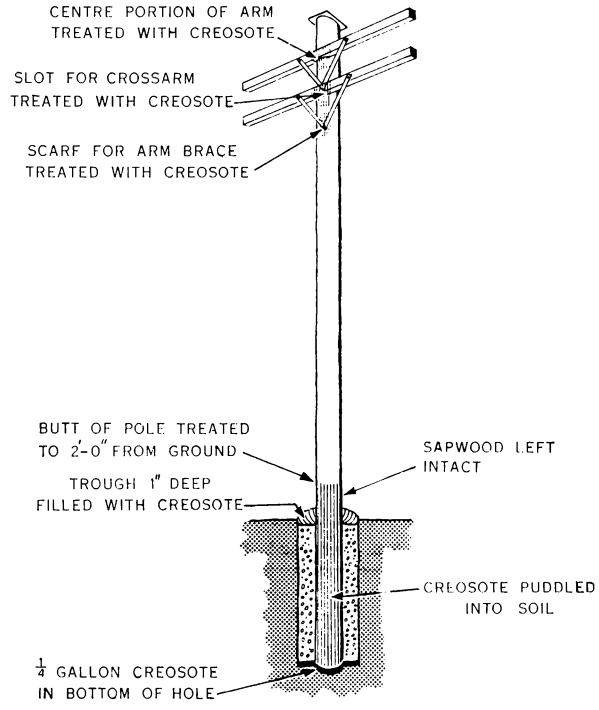
Length of Pole.	Depth of Pole Hole.	
	Soil, Clay, Sand, &c.	Solid Rock.
feet.	ft. in.	ft. in.
12	2 6	2 6
14	3 0	3 0
16	3 0	3 0
18	3 6	3 0
20	4 0	3 0
22	4 0	3 0
24	4 0	3 6
26	4 6	3 6
28	4 6	3 6
30	5 0	3 6

Preservative Treatment of Poles.

The use of creosote as a timber preservative will increase the life of the poles.

Apply a liberal coat of creosote to the butt of the pole and to about 2 feet above ground level and also puddle creosote into the pole hole as the soil is being replaced. You will need about 1 gallon per pole.

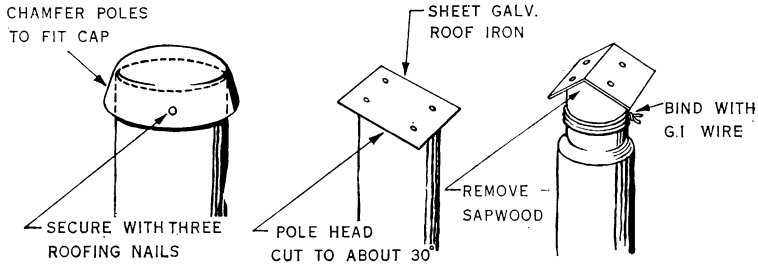
Treat all cut faces, arm slots and bolt holes on the pole with creosote.



Method of Treating Pole with Creosote.

Weather-proofing Heads of Poles.

To prevent the head of wooden poles from weathering and splitting, the use of pole roofs is desirable.

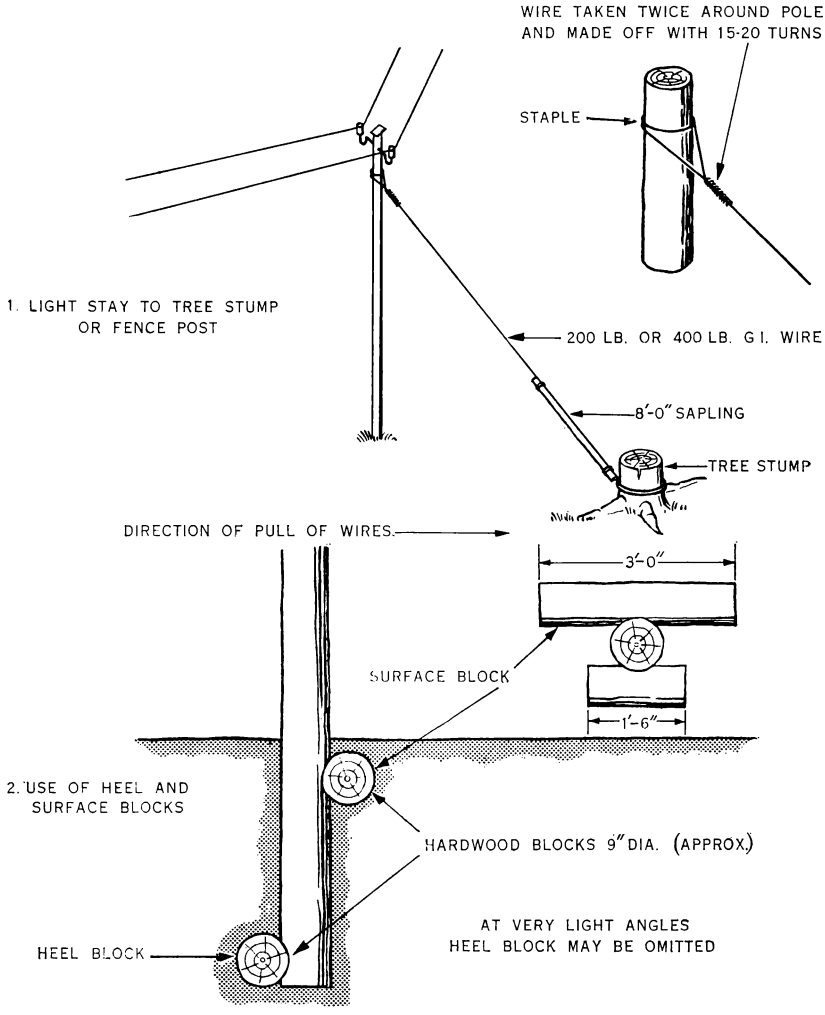


Methods of Weather-proofing Pole Heads.

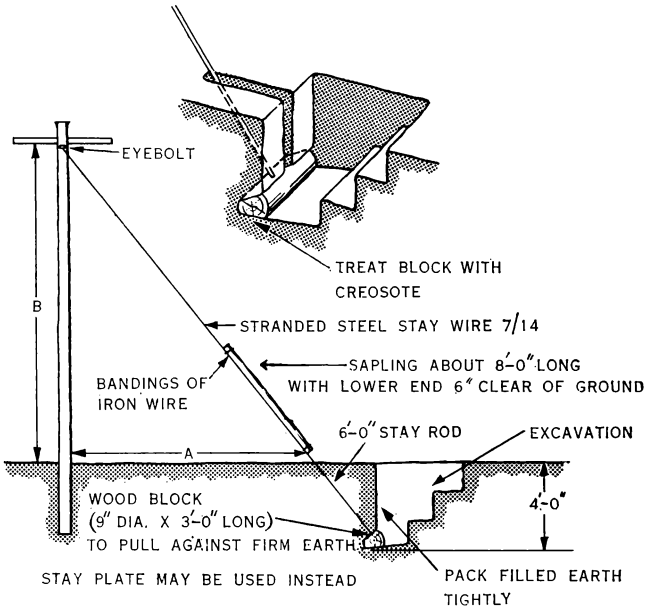
STAYING POLES.

Where the line makes a sharp turn or angle, the stress on the wires tends to pull the pole over and, consequently, you must provide some form of stay to hold the pole upright. Movement of an unstayed or inadequately anchored pole will increase the sag of the wires in the spans on either side of the angle allowing them to contact and cause faults on the telephone service.

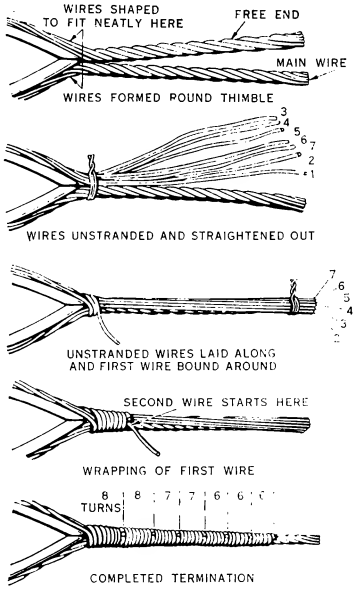
Where the stay wire is within reach of stock or traffic, lash an 8-ft. length of timber or a light sapling to it to serve as a guard. Keep the stay wire at least 2 inches clear of the line wires.



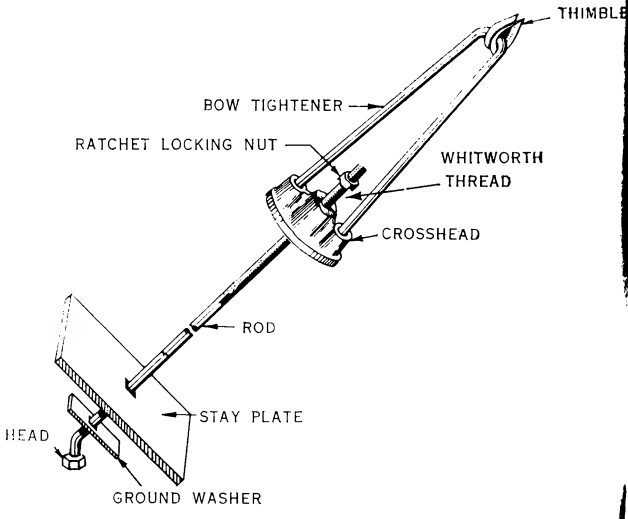
Stays for Routes Carrying up to Four Wires



Stays for Routes Carrying More than Four Wires (Wood Block or Stay Plate).



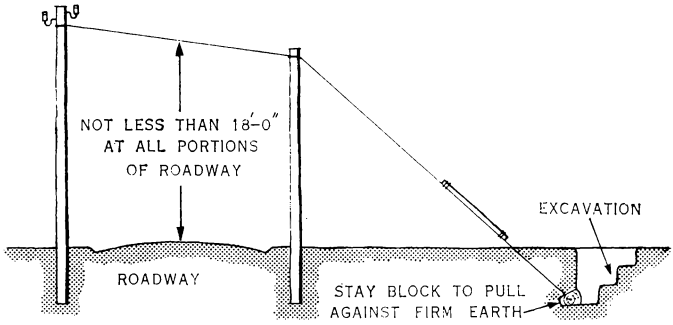
Terminating Stranded Steel Stay Wire.



Stay Rod Components. (Note :—Stay plate may be used instead of wood block).

Staying Pole Across Roadway.

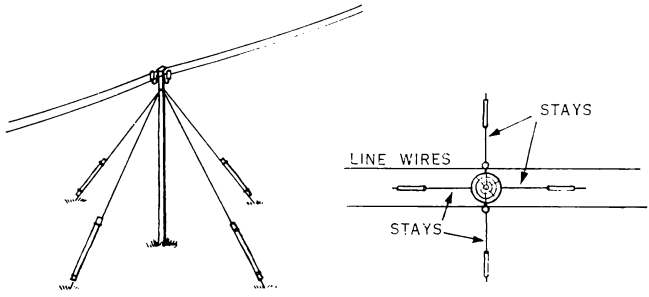
Where it is necessary to stay a pole across a roadway, erect a stay pole to provide a minimum clearance of 18 feet above road level for the stay wire.



Method of Staying Pole Across Road.

Staying Routes Constructed Across Open Country.

Provide anchor poles at approximately ½-mile intervals on lines constructed across open country where light poles are used on very long straight sections. Anchor poles assist considerably in stabilizing the route and are useful as tensioning points when erecting the line wires. Stay the pole in four directions, parallel with the wires and at right angles to the wires.

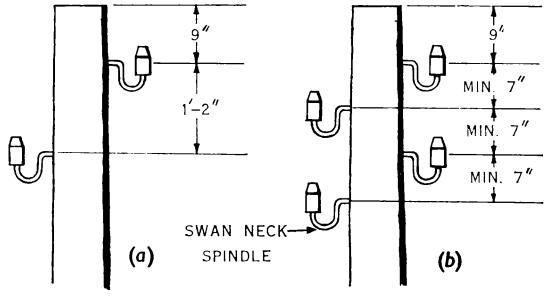


Anchor Pole Showing Method of Fitting Stays.

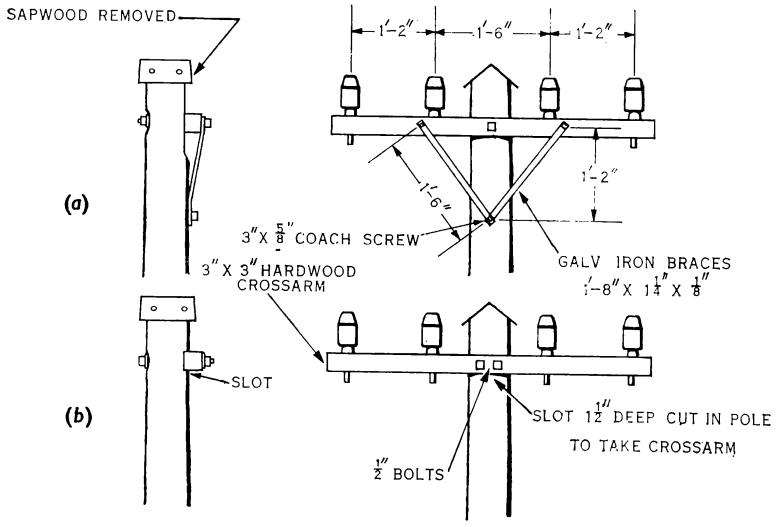
FITTINGS FOR ATTACHING WIRES TO POLES.

Attaching up to Four Wires.

Where the poles will carry no more than four wires, swan-neck spindles provide the most satisfactory means of attaching the wires.



Fitting Swan Neck Spindles.
(*a*) One Double Wire Line. (*b*) Two Double Wire Lines.



Alternative Methods of Fitting Crossarms for Four Wires.
(*a*) **Brace Method.** (*b*) **Slotted Pole and Double Bolt Method.**

If light wooden poles such as mulga and gidgee are used, there is a tendency for the poles to split when swan-neck spindles are fitted and in these cases a small crossarm bolted to the pole or a bolted shackle such as used by Electricity Authorities is recommended.

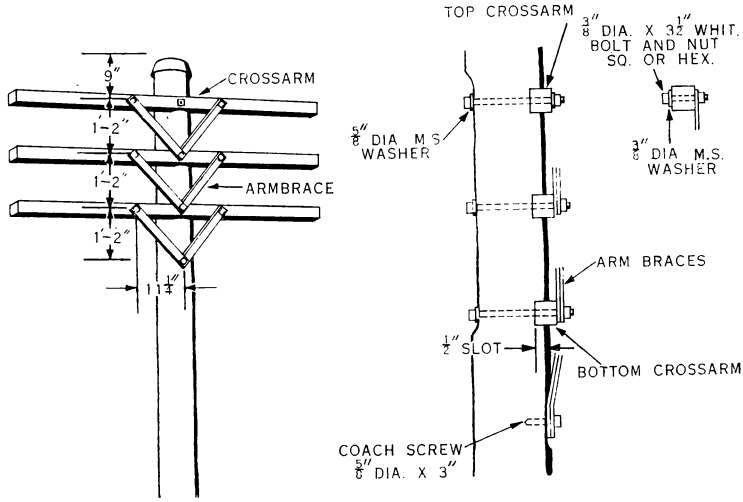
Attaching More Than Four Wires.

If more than four wires are to be erected, fit crossarms to the poles and use straight spindles to support the insulators. Wooden spindles may be used on straight line poles and steel spindles on poles where there is a sharp angle in the wires.

The crossarms should be of sound, seasoned hardwood 3 in. x 3 in. in cross-section. The length may vary from 2 feet to 9 feet according to the number of wires to be erected.

For uniformity and good appearance make crossarms on the same pole and the same line of poles all of uniform length, but on branch lines from the main route where fewer wires are carried the length of the arms may be reduced.

To attach crossarms cut slots in the poles to a depth of 1 in. to 1½ in. and secure them with a ⅝-in. diameter bolt through the centre. Use arm braces made from galvanized iron 20 in. x 1¼ in. x ⅛ in. to hold the crossarms rigid.



Fitting Crossarms and Braces.

MINIMUM WIRE AND CROSSARM SPACING.

Average Span Length Between Poles.	Wire Spacing.	Crossarm Spacing.
	in.	in.
Up to 55 yards ..	9	14
Over 55 up to 90 yards ..	14	14
Over 90 up to 110 yards	18	18

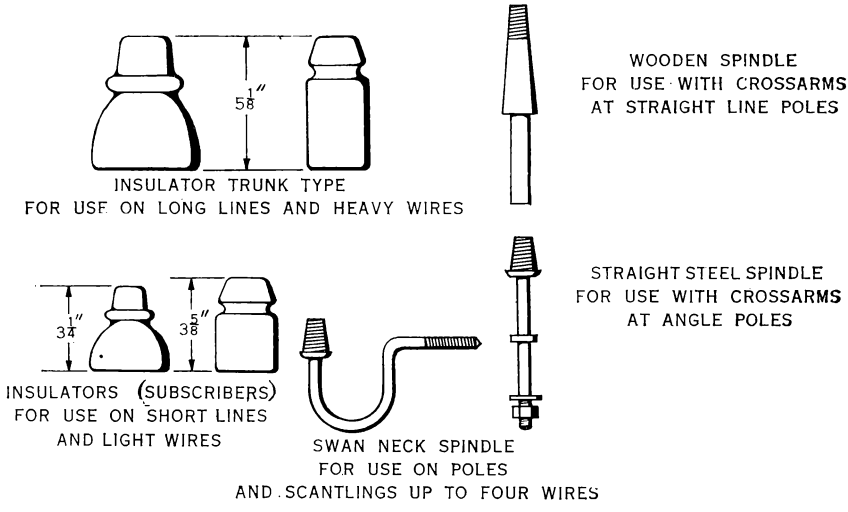
Insulators and Spindles.

In most cases the subscribers type insulator is satisfactory for lines up to 50 miles in length but where wire larger than 200-lb. galvanized iron is erected the trunk type insulator should be used at angles and at points where the line is terminated.

For long lines, particularly in coastal areas, trunk type insulators and spindles will be required.

Insulators may be porcelain or glass but only porcelain should be used at sharp angles and for 400 lb. per mile galvanized iron wire.

Where crossarms are fitted, use wooden spindles on straight sections and steel spindles at heavy angles, road crossings and electric power crossings.



Standard Insulators and Spindles.

ERECTING WIRES.

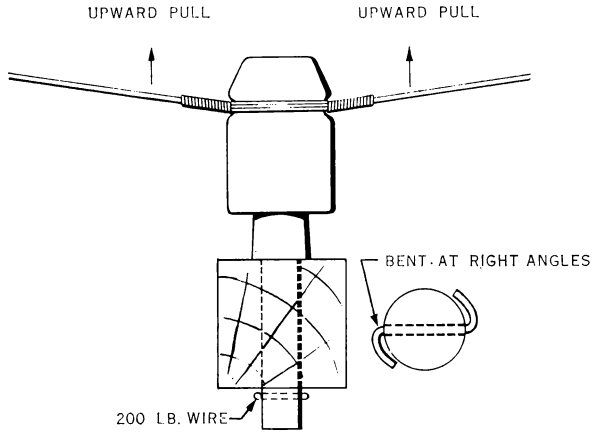
Running out Wires.

Handle all line wire carefully. Where copper wire is used do not throw or drop the coils to the ground because even a slight dent, nick or kink will seriously weaken the wire. If any damage does occur, cut out the damaged piece and rejoin the wire.

Take particular care to avoid damage to the line wire when running it out. The most suitable method is to mount the coil of wire on a large reel and draw the wire off the coil as the reel is carried along the route. Alternatively, the reel may be left stationary and the wire drawn off, but this should not be done where the route crosses rocky ground which may damage the wire.

Erecting Wires near Power Lines.

Telephone lines should be erected well clear of power lines wherever possible. Apart from the risk of actual contacts between telephone lines and power wires, which could result in fatal accidents, electric currents may be induced in the line causing serious interference to the telephone service and, in the case of faults on the power line, possible danger to the telephone user.



Method of Securing Wood Spindle where there is an Upward Pull on Line Wire.

Telephone wires must not be placed on the same poles as high tension power lines and the further they are erected from any power lines the better. Where there is no practicable alternative, telephone wires may be attached to not more than one pole carrying low tension (under 650 volts) electricity mains, provided permission for the attachment is given by the Electricity Authority and the telephone wires are erected at least 4 feet beneath the power wires.

When it is not possible to completely avoid electric power lines and it becomes necessary to erect a telephone line across or close to such a line, certain conditions must be observed regarding clearances. Particular care is necessary during the erection of the telephone line to prevent contact with the electric power wires.

Minimum Clearances Between Telephone Wires and Power Wires.

Telephone wires must, in all cases, cross beneath power wires and have at least the following clearances from the nearest power wires:—

Voltage of Power Lines.	Minimum Clearance in Feet.
Up to 650 volts (wires crossing in span) ..	3
Up to 650 volts (wires crossing within 8 feet of telephone pole)	4
Over 650 volts, not exceeding 11,000 volts	4
Over 11,000 volts, not exceeding 66,000 volts	6
Over 66,000 volts, not exceeding 132,000 volts	8
Over 132,000 volts, not exceeding 220,000 volts	12
Over 220,000 volts	12 plus 1 foot for every 20,000 V. over 220,000 V.

It is stressed that these are minimum clearances and you should make due allowance for any factors, such as increase in sag of the power wire in hot weather, which may reduce the clearances between the telephone and power wires.

Consult the Power Authority regarding voltages carried by the power lines.

Do not attempt to measure the clearance between telephone wires and power wires yourself; if an approximate measurement by sighting leaves any doubt that the required clearance exists, request the Electricity Authority to measure the clearance.

Safety Precautions When Working Near Electric Power Lines.

Before commencing any work in the vicinity of electric power construction discuss with the local Post Office Line Foreman or Electricity Authority representative the precautions necessary to avoid danger to yourself on the job.

Whenever the telephone lines will cross beneath electric power wires take the following precautions when erecting the wire:—

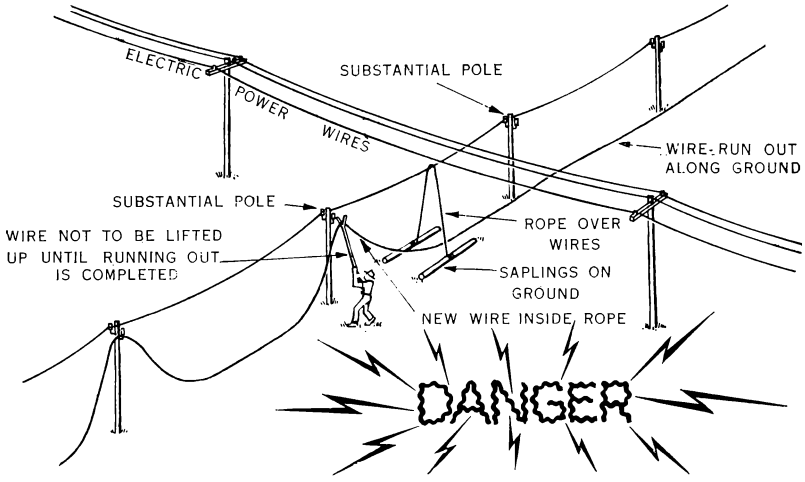
★ Fit a rope guard over the telephone wire immediately under the power wires to prevent the wire flicking or bouncing in the direction of the power wires. Anchor the rope to two saplings on the ground as illustrated.

★ Completely run out wire along the ground then lift it onto the poles. Pass the wire through the rope guard at the electric light crossing.

★ It is easy for a wire with a joint or a kink to catch on a bush or other obstruction and break or fly upwards and contact the power wires if it is pulled; so do not pull or jerk the wire if it catches—find the reason and free it.

★ Wear electrical worker's heavy rubber gloves while handling the wire. Rubber boots also provide additional protection.

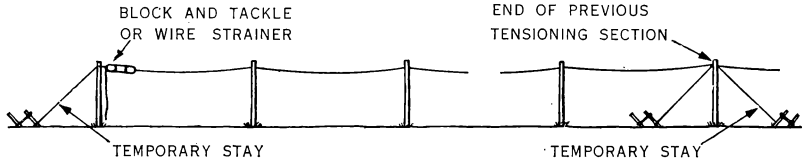
The need for exercising the utmost care and taking every possible precaution to prevent the telephone wire coming in contact with the power wire cannot be emphasized too strongly. Fatal accidents have occurred where these precautions have not been taken.



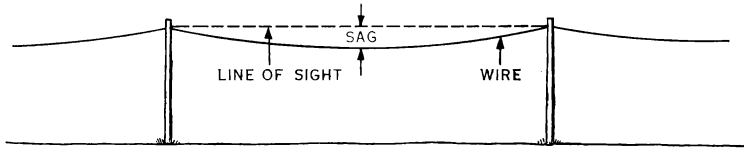
Erecting Telephone Wires under Electric Power Lines.

Tensioning Line Wires.

Tension the line wire approximately every ½ mile, using a block and tackle or similar tensioning device. Reduce the length of the tensioning section where there are a number of angles in the route and make the angle pole the end pole of the section. Fit temporary stays at the tensioning points to hold the poles in position while the wire is being tensioned.



Method of Tensioning Line Wire.



Measurement of Sag in Wires.

The following table of sags will serve as a guide to suitable tensions for the various classes of wire:—

Sags for all Galvanized Iron Wire. 100-lb. and 200-lb. Copper Wire: 118-lb. and 237-lb. Cadmium Copper Wire.

Temperature in Degrees Fahrenheit.	Sag in Inches for Average Span Length of—				
	45 yards.	65 yards.	80 yards.	90 yards.	110 yards.
30° ..	6	12	19	23	35
40° ..	6	14	20	26	39
50° ..	7	15	22	29	43
60° ..	8	16	25	31	46
70° ..	8	18	27	34	51
80° ..	9	19	29	37	55
90° ..	11	21	32	41	61
100° ..	12	23	35	45	66
110° ..	13	26	39	49	73
120° ..	15	28	42	53	79

Light (40-lb. and 70-lb.) Cadmium Copper Wire.

Temperature in Degrees.	Sag in Inches for Average Span Length of—	
	45 yards.	65 yards.
30° ..	5	10
40° ..	5	11
50° ..	6	12
60° ..	6	13
70° ..	7	14
80° ..	7	16
90° ..	8	17
100° ..	9	18
110°	10	20

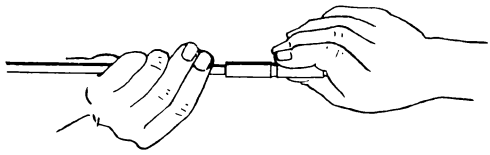
When applying these tables take care to allow for the temperature prevailing when the wire is erected. If, for example, light copper wire is erected on 60-yard spans with a sag of 14 inches when the temperature is 90 degrees this sag will contract to about 9 inches when the temperature drops to 30 degrees. If the amount of sag allowed

in the wire when the temperature is 90 degrees were less than 14 inches it will be correspondingly less when the temperature falls, with the result that the wire will be too tight and may snap or tend to pull its supports out of position.

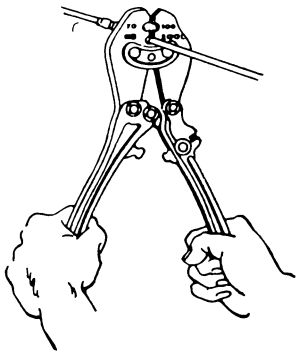
JOINTING WIRES.

How to Make a Press-type Sleeve Joint.

Press-type sleeves are the most effective means of jointing wires. Supplies of sleeves for all standard sizes of line wire may be purchased from the Post Office. If necessary, jointing tools may be hired from the Post Office.



Inserting Wire into Sleeve.



Crimping The Sleeve.

Clean the ends of the wires to be jointed with fine emery cloth and remove any burrs. Straighten the wires if necessary and insert the ends into the sleeve from either end until they reach the centre stop. If they will not go right in, remove and clean again. Do not twist the wires on the sleeve as this damages the internal surface.

Inner Crimps.

Pinch the sleeve lightly with cutting pliers on each side of the centre to hold the wires in position while the joint is being completed.

Operate the jointing clamp by opening the handles fully, placing the tool so that the sleeve is between the correct grooves, with the handles at right angles to the line wire, then closing the handles until the handle stops meet. Make adjacent crimps with the handles of the jointing clamp on opposite sides of the sleeve.

Outer Crimps.

Crimp the sleeve twice on each half of the sleeve. Make the inner crimps first, approximately 1/16 in. from the centre of the sleeve.

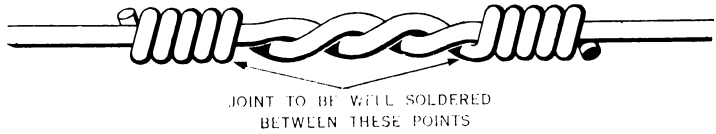
In the case of 40-lb. cadmium copper wire, make three crimps on each half of the sleeve.

How to Make a Twist Joint.

Use a Twist Joint for galvanized iron wires when sleeves are not available.

Clean the ends of the wire to be joined and overlap them for about 12 inches. Make two twists at the centre of the joint then bind the loose ends tightly around the line wire at each end for five turns.

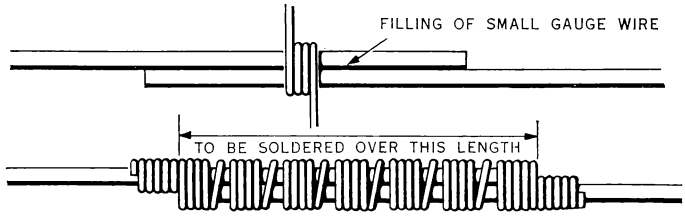
Solder the centre of the joint to ensure a good electrical connection.



Twist Joint.

How to Make a Britannia Joint.

The Britannia Joint is the most effective alternative to the sleeve joint for copper wire. Clean the ends of the wire and overlap them for approximately 3 inches. Bind the joint tightly with soft copper wire. In the case of very large wires, use a filling of small-gauge wire between the two line wires. Solder the completed joint.



Britannia Joint.

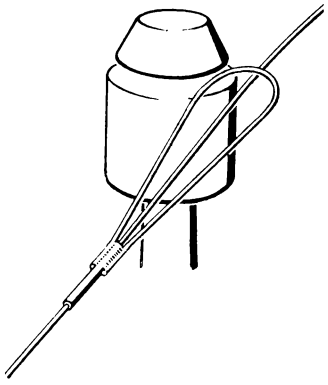
Soldering Britannia and Twist Joints.

When making Britannia or Twist Joints, clean both the line wires and the binding wire with fine emery or glass paper, otherwise the solder will not take. Apply a suitable soldering flux (e.g., Bakers Solution) to the joint, and after the soldering has been completed wipe off any surplus fluid as this may corrode the wire. The soldering iron should be hot enough to allow the solder to flow freely into the whole of the space between the wires. At the same time, especially if copper wire is soldered, care must be taken to guard against " burning " the wire by using an excessively hot soldering iron. This weakens the wire at the joint, resulting later in a broken wire. If the wires are not cleaned and the soldering is not properly performed it

may mean that the outside only is covered with solder and that there is no firm metallic connection between the two wires in which case the joint will be only equal to an unsoldered or dry joint and will cause faults.

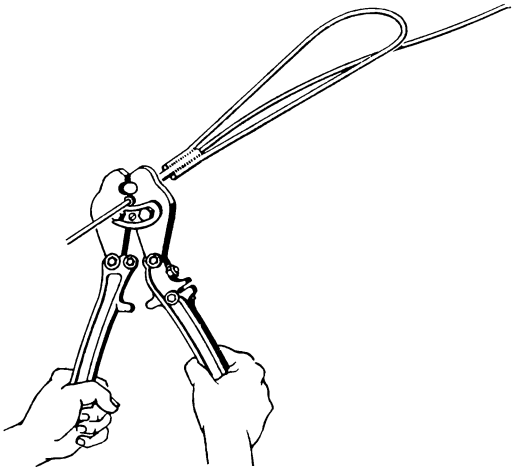
TERMINATING WIRES.

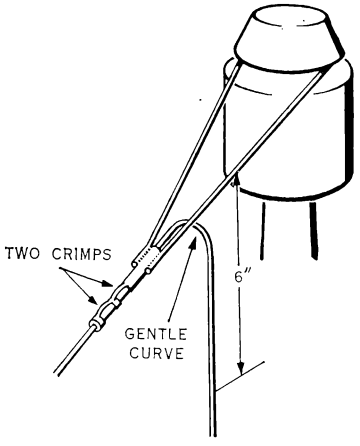
How to Make a Sleeve-type Termination.



Pass the line wire through the sleeve until 6 inches of wire protrudes. Where the line wire is under tension, thread the sleeve on to the wire until it is opposite its ultimate position on the insulator.

Crimp the sleeve in two places, holding the handles of the jointing tool on opposite sides of the sleeve for the two crimps.

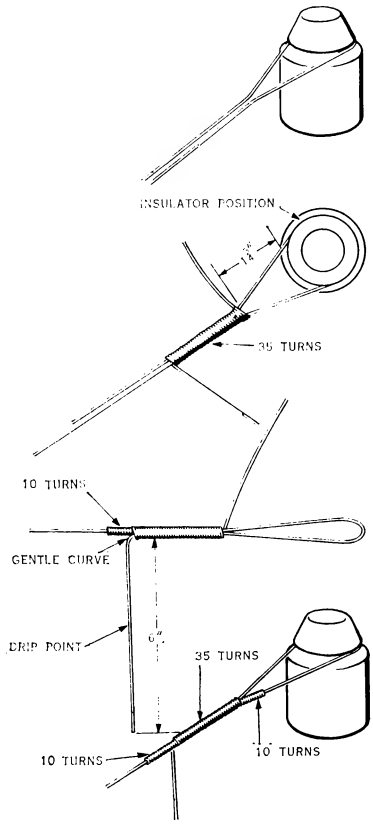




Carefully bend the free end of the line wire downwards at right angles and cut off to 6 inches to form the drip point.

Place the wire loop over the insulator and press it neatly around the groove.

How to Make a Wrapped-type Termination.



Covered Wire Connection—See Page 44.

1. Bend wire around insulator in an anti-clockwise direction allowing sufficient length for the termination and drip point.

2. Commencing at a point $1\frac{3}{4}$ in. from insulator groove, bind the free end to the main wire with 35 turns of binding wire. Leave sufficient binding wire at the insulator end to make ten turns around the main wire towards the insulator.

3. Bend the free end of the line wire downwards at right angles taking care not to make the bend too sharp. Then continue binding around the main wire for a further ten turns.

4. Bind other end of binding wire around the main-line wire towards the insulator for ten turns. Cut off excess binding wire.

Place termination loop over the insulator and press it neatly around the groove.

BINDING WIRE FOR TERMINATION.

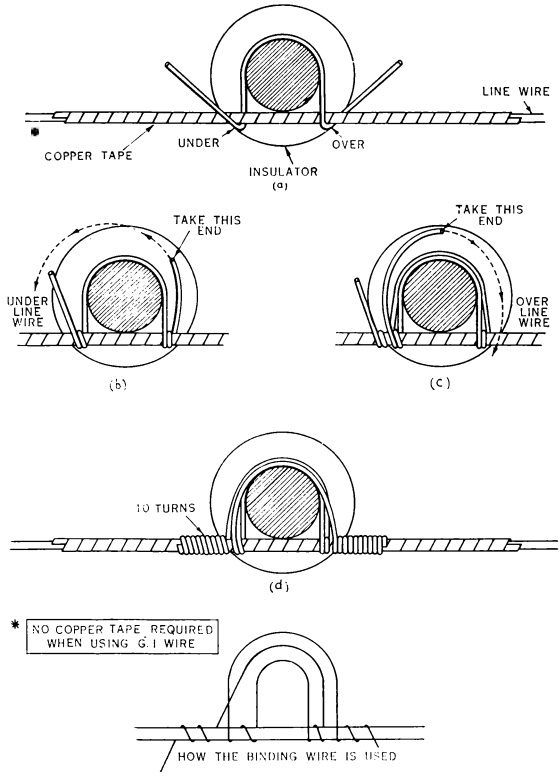
Size of Line Wire.	Length of Binding Wire.	Size of Binding Wire.
200 lb. galvanized iron ..	44 in.	60 lb. galvanized iron
400 lb. galvanized iron ..	48 in.	60 lb. galvanized iron
40 lb. cadmium copper ..	20 in. ..	20 lb. soft copper
70 lb. cadmium copper ..	28 in. ..	50 lb. soft copper
100 lb. copper ..	32 in. ..	50 lb. soft copper
237 lb. cadmium copper	44 in. ..	50 lb. soft copper

ATTACHING WIRES TO INSULATORS.

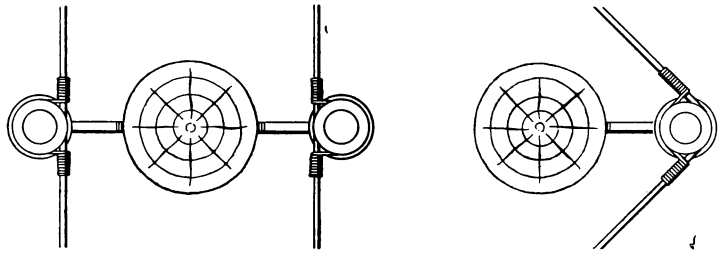
Tie the line wire to the side of the insulator nearest the pole except at angles where the wire should be placed so that it bears against the insulator.

Bind the line wire so that it is held firmly against the insulator but not so tight that it will bend and tend to be pulled around the insulator.

Do not use pliers when making the tie otherwise trouble may be experienced later by broken wires where the surface of the line wire has been nicked.



Tieing in Line Wire.



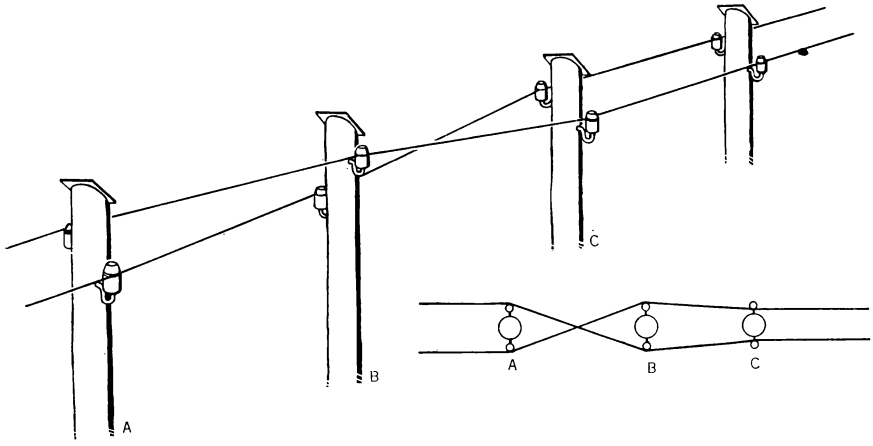
STRAIGHT LINE POLES ANGLE POLES

Correct Side of Insulator to Attach Wires.

INSTALLING TRANSPOSITIONS.

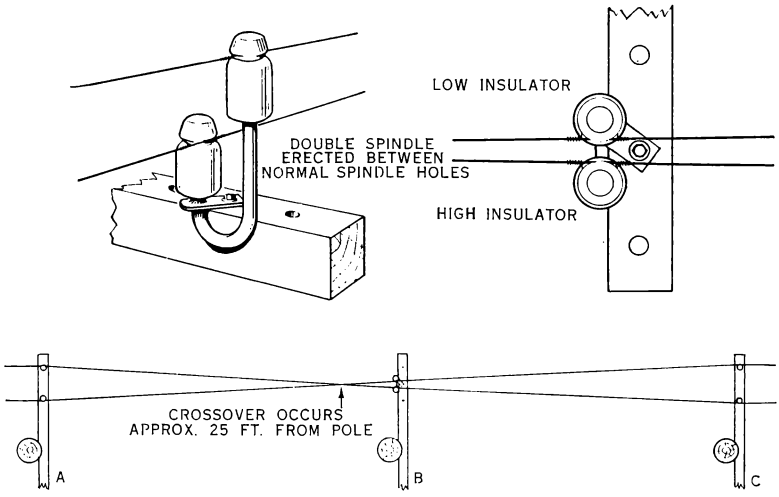
Where metallic circuit lines are erected close to other telephone lines or power lines, it is necessary to reverse the positions of the wires on the poles at intervals. This is arranged by inserting " transpositions " or " cross-overs " in the wires and will eliminate crosstalk (that is, overhearing speech from other telephone lines) and power hum.

Transpositions are generally made at ¼-mile or ½-mile intervals along the section of line subject to interference. You will be advised by the Post Office of the positions where transpositions will be required in your line.



Transpositions Using Swan-neck Spindles.

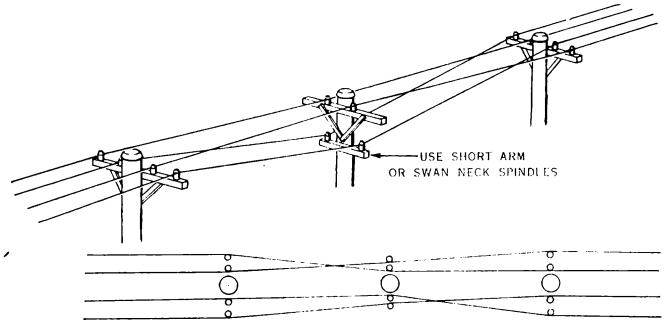
Reverse positions of swan-neck spindles at transposition pole *B*. Run upper wire (left-hand side) from pole *A* to upper position pole *B* (right-hand side) and lower wire (right-hand side) from pole *A* to lower position pole *B* (left-hand side). The transposition occurs in the span between poles *A* and *B*.



Transpositions Using Double Spindles.

Mount the double spindle on the crossarm midway between the normal spindle holes using a 4-in. x ½-in. galvanized bolt.

Run the right-hand wire pole *A* to the low-insulator pole *B* and then to the left-hand position pole *C*. Run the left-hand wire pole *A* to the high-insulator pole *B* and then to the right-hand position pole *C*. Tie wires to the inside of the insulators at the transposition spindle and on the outside of the insulators at the poles on either side of the transposition poles. On angle poles tie the wires so that they pull against the insulator.



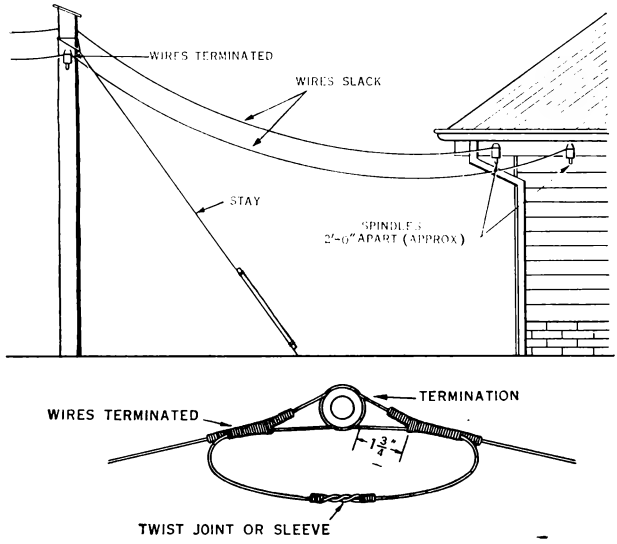
Alternative Method of Transposing Two Pair of Wires when Double Spindles are not Available.

ATTACHING WIRES TO BUILDINGS.

Terminate the line wires on the last pole before the house and make the lead-in span as short as possible with the wires slightly slacker than the main route. This will reduce the strain on the house imposed by the pull of the line wires.

Securely affix the spindles on the building to solid timber or masonry as close as convenient to the point where the telephone will be installed but in a position which will keep the telephone wires well clear of any electric light wires.

The wiring between the termination of the line wires on the building and the telephone will be installed by the Post Office.



Typical Lead-in to Building.

INSTALLING EARTH WIRES.

Earth Connection at Telephone.

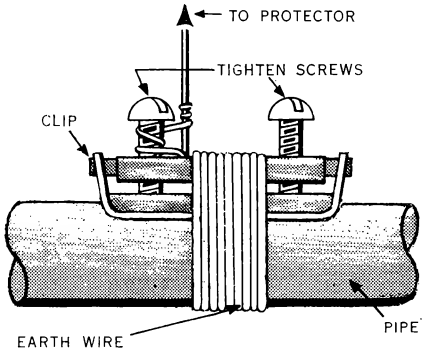
The best earth connections are those which are attached to pipes of a water supply system which go underground for some distance. Make the connection to a length of pipe which enters the ground so that there is no joint in the pipe between the earth connection and the point of entry to the ground. Do not connect to non-metallic pipes (e.g., plastic) or to pipes from house tanks erected above the ground as these are useless. If the water pipe is used for earthing the electric light system, do not use it for the telephone " speaking " earth from a single-wire line.

If an underground water supply system is not available, the next best arrangement is an earth stake. Make the stake from a 6-ft. length of 1-in., ¾-in. or ½-in. galvanized pipe, or ½-in. iron rod and

drive it vertically into the ground to within 3 or 4 inches of its length in a damp location. Attach the earth wire to the head of the pipe above ground level.

Use bare copper wire (50 lb. per mile soft copper) for the earth lead.

Connect the earth lead to the water pipe or earth stake by means of an earth clip supplied by the Post Office. Clean both the wire and the pipe with fine emery cloth before making the attachment. If an earth clip is not available, make three or four turns of wire around the head of the earth stake and thoroughly solder the connection. This method is suitable for earth stakes only, as a satisfactory soldered joint cannot be made to a pipe containing water.



Method of Fitting Earth Clip.

The Post Office will install the earth wire for all new services in conjunction with the installation of the telephone.

In certain districts, special arrangements such as burying a 50-yard length of copper wire at a depth of 2 feet may be necessary to obtain satisfactory earth connections. The Post Office will advise you of the procedure to be adopted if this should be necessary in your case.

Earth Connection at Junction with Post Office Pole Route.

In the case of single-wire lines it is essential that the earth connection at the junction with the Post Office pole route be well separated from the earths of other lines to obviate crosstalk. Where more than one single-wire line connects to the transformer pole it will be necessary to erect a second wire from the transformer pole back along your pole route until you reach a point at least one span from the earth connection of any other line for the installation of the earth wire.

HOW TO CONSTRUCT A SCANTLING LINE

This type of construction is only suitable for one or two wires using spans not greater than 2 chains with wires at 8-ft. clearance from the ground.

Material Required.

Hardwood scantlings not less than 3 in. x 2 in. Length 11 feet for one wire, 12 feet for two wires.

Bolts ½-in. diameter—two per scantling for attaching scantling to fence post.

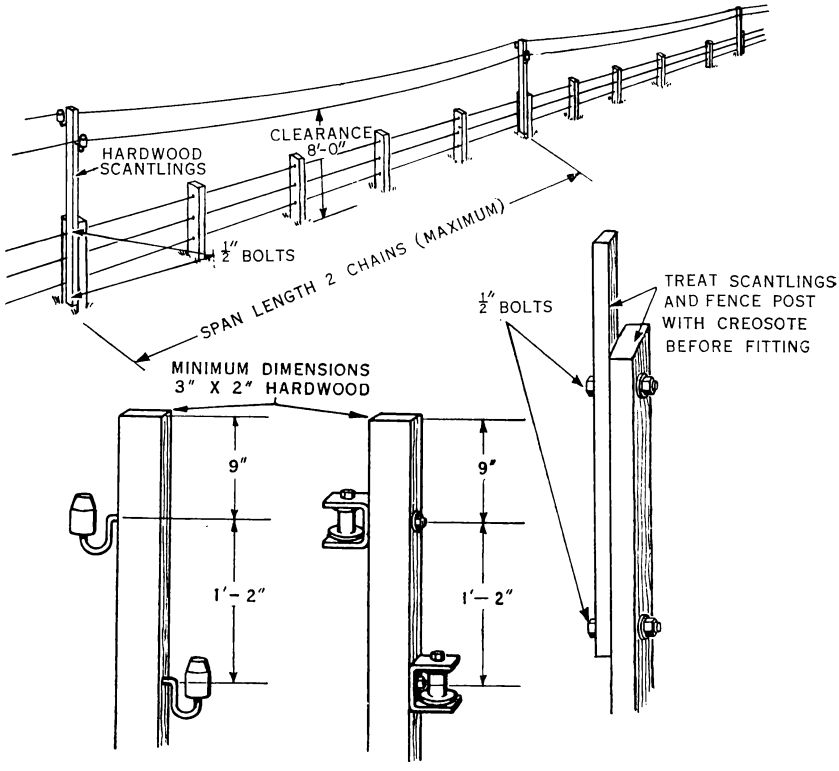
Swan-neck spindles and insulators.

Where light timber, which has a tendency to split when swan-neck spindles are fitted, is used, a bolted shackle such as used by Electricity Authorities may be substituted.

Erecting Line.

Attach the hardwood scantlings at 2-chain intervals to the fence posts by means of two ½-in. diameter bolts. The larger dimension of the scantlings should be at right angles to the wire as illustrated. Use only good, sound fence posts and treat both scantlings and fence posts with creosote to 2 feet above ground level.

Erect the line wire and attach to the supports in accordance with the methods described in " How to Construct a Pole Line ".



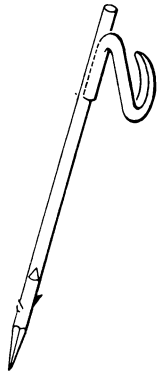
Method of Constructing Scantling Line.

HOW TO CONSTRUCT A TREE LINE

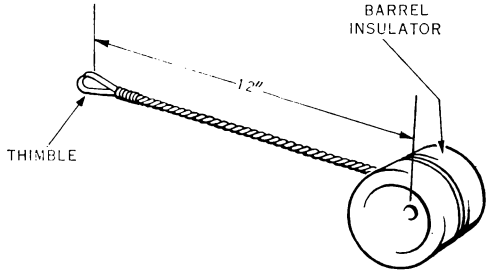
Material Required.

The gauge and type of wire to be used depends on the electrical requirements of the circuit and the Post Office will advise the most suitable wire for your service. Galvanized iron wire 200 lb. per mile (approximately No. 11 gauge) is generally satisfactory but in the case of long lines 400 lb. per mile galvanized iron wire or 237 lb. per mile cadmium copper wire may be necessary.

Tree slings are used to support the wires in most instances, but swan-neck spindles are suitable on large trees which do not sway appreciably in the wind and on any intermediate poles.



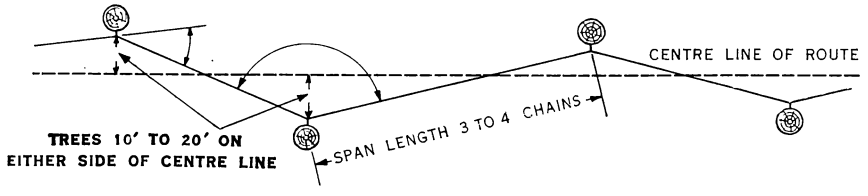
Tree Spike.



Tree Sling.

Selecting Trees.

Select trees 3 to 4 chains apart so that there is a slight zig-zag in the line which tends to pull the tree sling away from the tree.



Tree Line Showing Zig-zag in Route.

Use only trees which are sound and substantial enough to carry the load of the wires. Light timber which has considerable movement in the wind is unsuitable. Wherever practicable lop the trees to minimize swaying in the wind which causes the line to chafe or work loose at adjacent supports.

At points along the route where suitable trees are not available erect poles and attach the wires by means of a swan-neck spindle or tree sling.

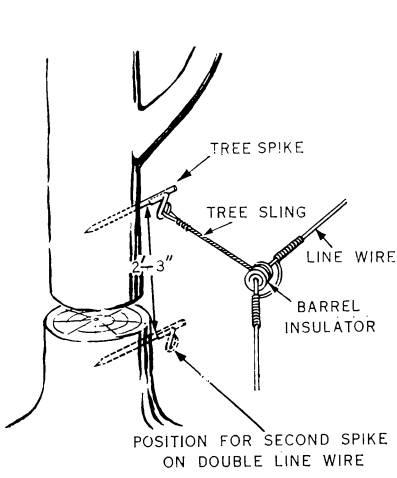
Clearing Timber.

Remove any undergrowth or trees which may foul the line wire. Avoid leaving limbs or trees which are likely to fall across the line.

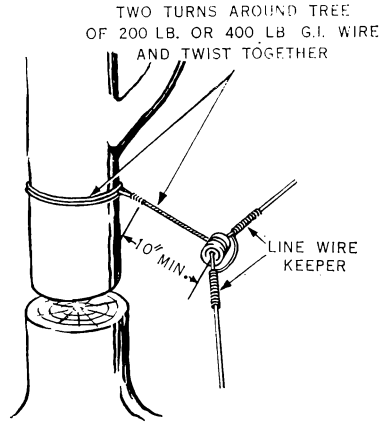
Erecting Wire.

Fit tree-sling spikes to the trees at a height sufficient to maintain the minimum standard clearances for the line above ground level, that is, 12 feet at roadside and 18 feet across roads.

Run out the line wire along the ground, taking particular care if copper wire is used to avoid damaging it by kinks or nicks. Thread tree slings on to the line by passing the wire through the centre hole of the barrel insulator. Raise the wire and attach the tree slings to the tree-sling spikes previously fitted.



With Tree Spikes.

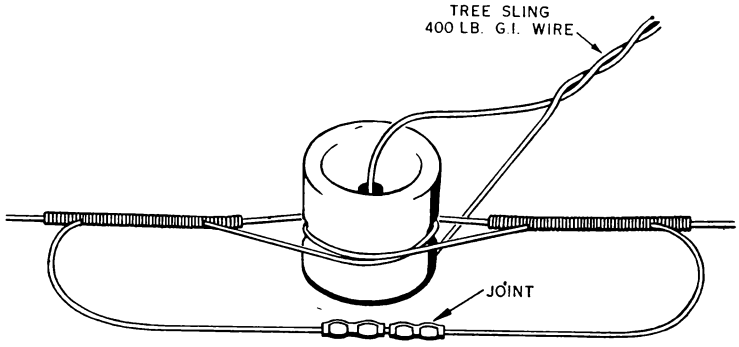


When Spikes not Available.

Tension the wire approximately every half mile using a block and tackle or other suitable wire-tensioning device. The tension applied should be dictated by the nature of the supports but in any case the amount of sag must not be less than that recommended for pole lines.

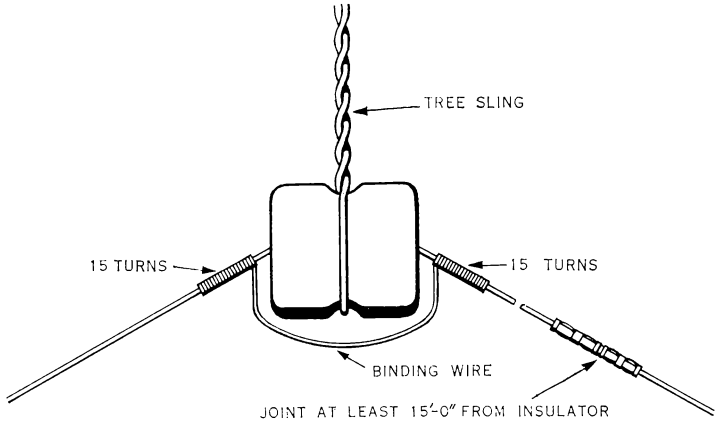
Wherever practicable allow sufficient slack so that the line may be drawn to the ground without breaking should a tree fall across the route. (For reference see page 30.)

Terminate the wire at each tensioning point, at sharp angles in the route, and on both sides of road or railway crossings.



Method of Terminating Wires.

To prevent the wire pulling through the insulator for any distance if it should break, fit a keeper wire at every fifth support.



Method of Fitting Keeper Wire.

Make joints in the line wire in accordance with the methods shown on pages 31–32. Keep the joints at least 15 feet from tree slings.

INSPECTING THE COMPLETED LINE

On completion of your line it must be inspected by a Post Office representative to ensure that it conforms to the prescribed standards before it can be connected to the telephone exchange. You will be charged the cost of the inspection to a maximum of £2 and required to provide transport for the Inspecting Officer if requested.

It will be desirable for you to be present at the inspection so that any defects can be pointed out by the Inspecting Officer. If the line is not constructed satisfactorily in the first instance, an additional inspection will be necessary after the defects have been rectified and you will be charged the actual cost of any such inspections. The line will not be connected until all defects have been rectified.

★

INSTALLING THE TELEPHONE

The telephone, protective apparatus, earth connection and internal wiring will be installed by the Post Office.

You may be required to assist in carrying out the installation, and to provide transport if requested.

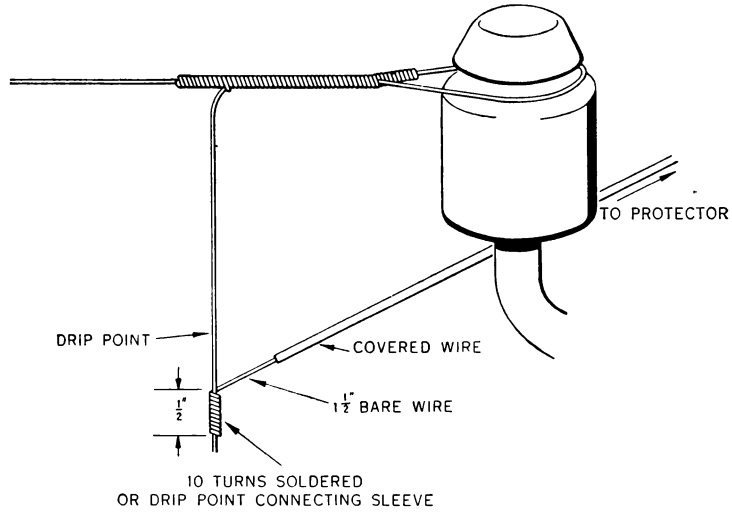
★

HOW TO KEEP YOUR TELEPHONE LINE IN GOOD ORDER

Post Office telephone lines are kept in good order by inspecting them regularly and removing any conditions which might cause a breakdown of service at some later date. Damage to the lines by storms cannot always be prevented but much can be done to minimize this damage. Regular inspection of your line can prevent a lot of faults and save you the trouble and inconvenience that a breakdown causes. A thorough inspection of the line about every six months is generally adequate but you should not neglect any opportunity to examine a portion of the line if you happen to be passing nearby between inspections.

COME WITH US ON A TYPICAL INSPECTION OF A PRIVATELY CONSTRUCTED LINE. We will show how to make the inspection and how to repair some of the defects which we encounter. Starting at the residence we will examine the house wiring and the telephone, and then follow the line along to the junction with the Post Office line route to check the condition of the poles, wires and fittings.

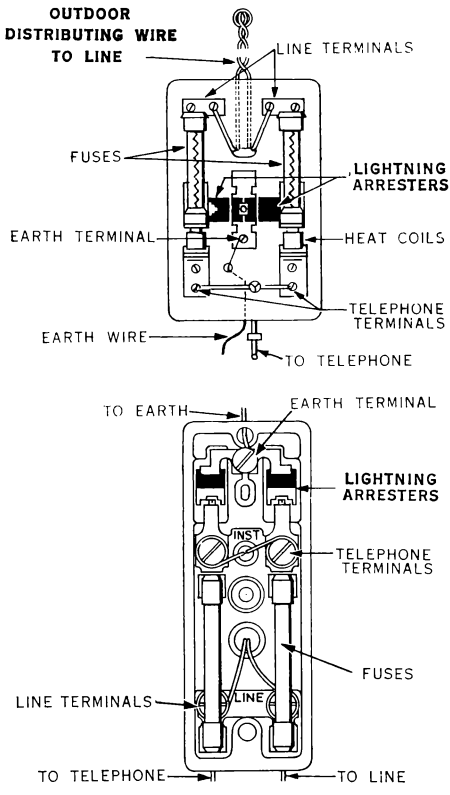
Inspect the Line Wire Termination and the Covered Wire Lead-in.



Check the connection between the covered wire and the line wire. If there is any evidence of the covered wire being corroded (that is, eaten away) remake the joint. Solder the joint or fit a special drip point connecting sleeve.

Examine the covered wire between the drip points and the protector. If the insulation is cracked or damaged, replace the wire.

Check the Protector.



The protector is installed for the protection of your instrument in the event of a lightning strike or contact with power lines, and is designed to divert such harmful electric currents to earth.

Check that the connections to the line, instrument and earth terminals are tight.

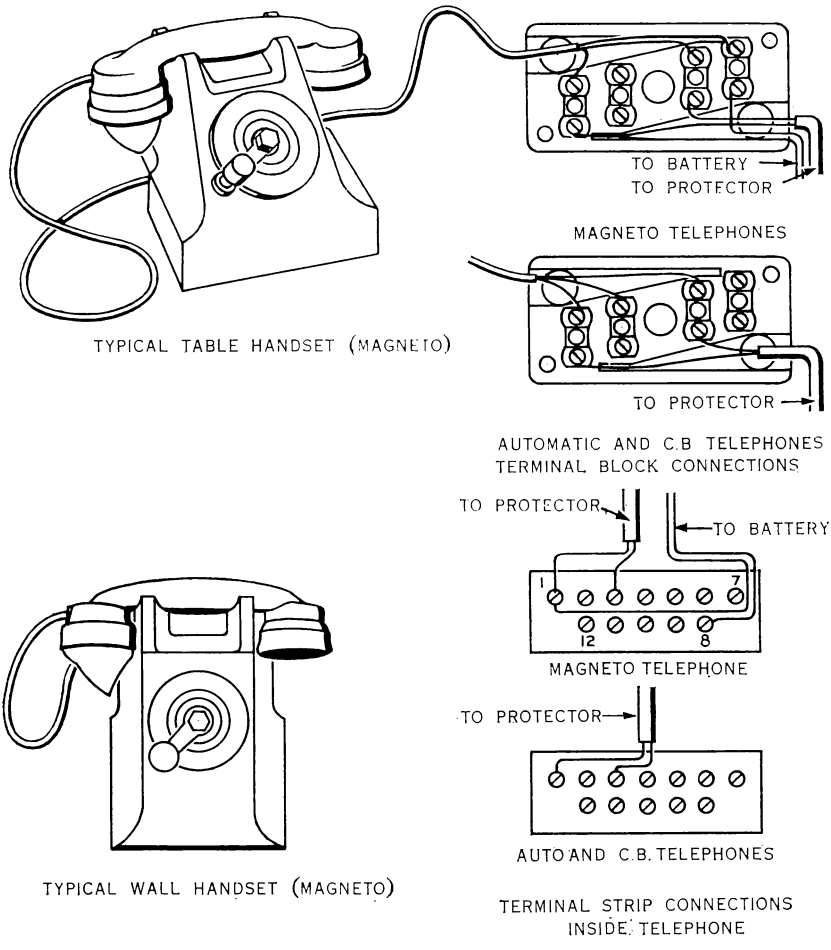
Remove the arrester blocks and clean them by rubbing lightly with a cloth. If they are badly pitted fit new blocks.

Check that the fuses are making firm contact with the spring clips.

Heat coils are not necessary and are no longer fitted to protectors. If you have an early-type protector containing this equipment, fit " dummy " heat coils or bridge the heat coil terminal springs with a length of copper wire and solder it in position.

Lightning arrester blocks and fuses for replacement purposes, and " dummy " heat coils may be obtained free of charge from the Post Office Technician.

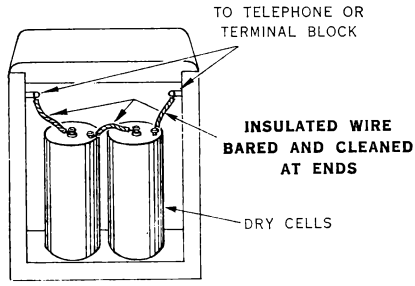
Inspect the Wiring to the Telephone.



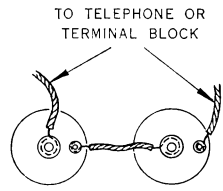
Check the termination of line wires at the terminal block or telephone. The wires should be clean and the terminals tight.

Examine the telephone cords for signs of damage. Hold the receiver to your ear and shake the cords. (If the service is automatic, first dial " 2 " to remove dial tone.) If scratching or crackling noises are heard the cord is defective and the telephone should be sent to the Post Office Technician for repairs.

Examine the Earth Wire.



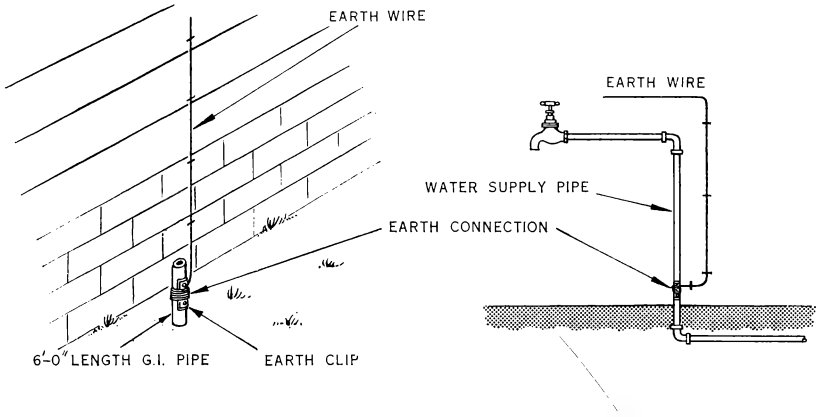
Battery Compartment.



Plan of Top of Cells Showing Correct Method of Connecting Terminals.

Check that terminals are tight and holding the wire firmly.

Inspect the batteries for signs of leakage through the case which will indicate that the cell is faulty. Obtain replacements, where necessary, from the Postmaster or Post Office Technician.

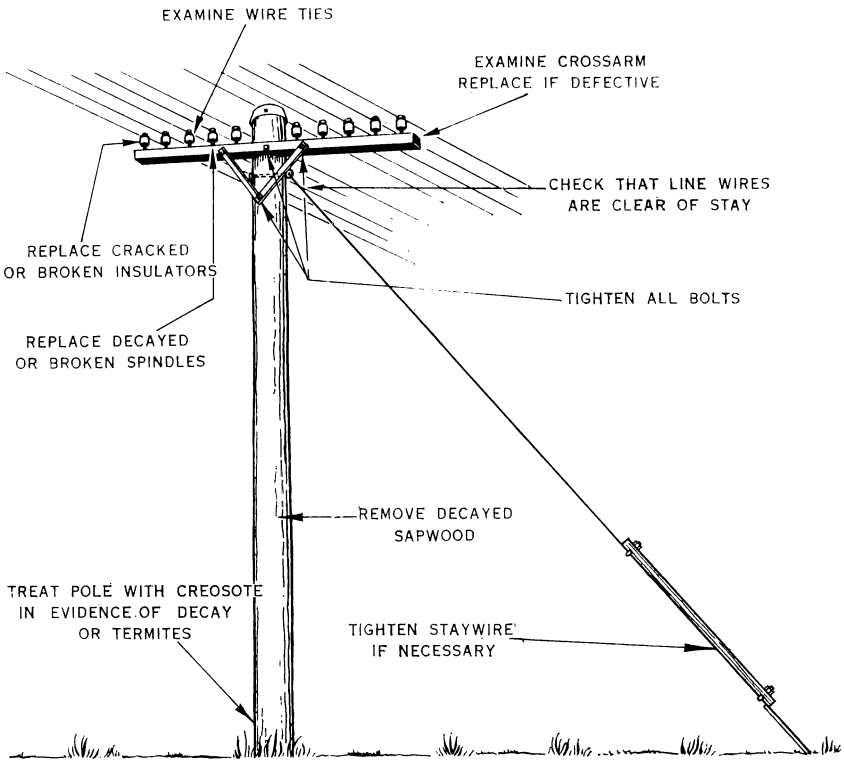


The earth connection is important particularly with single-wire lines which will not function correctly unless a good earth is provided.

Check that the connection to the water pipe or earth stake is tight, clean and making good contact, and that the wire to the protector has not been damaged.

If an earth stake has been used, make sure that it has been installed in a damp location.

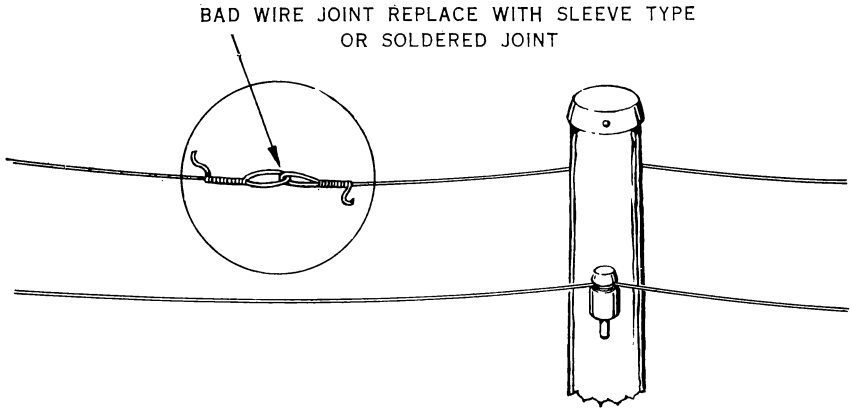
Inspect Wires and Fittings at Each Pole.



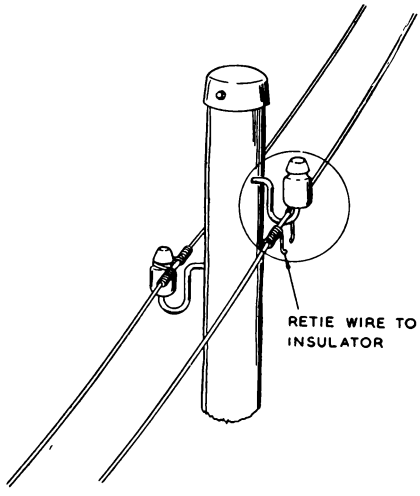
It is generally satisfactory to inspect the line from the ground but periodically, depending on the general condition of the line, it is advisable to climb every pole and make a thorough examination of the wires and fittings.

As you walk along the route, watch for any conditions which might cause your line to become faulty. HERE ARE SOME TYPICAL DEFECTS WHICH YOU MAY ENCOUNTER.

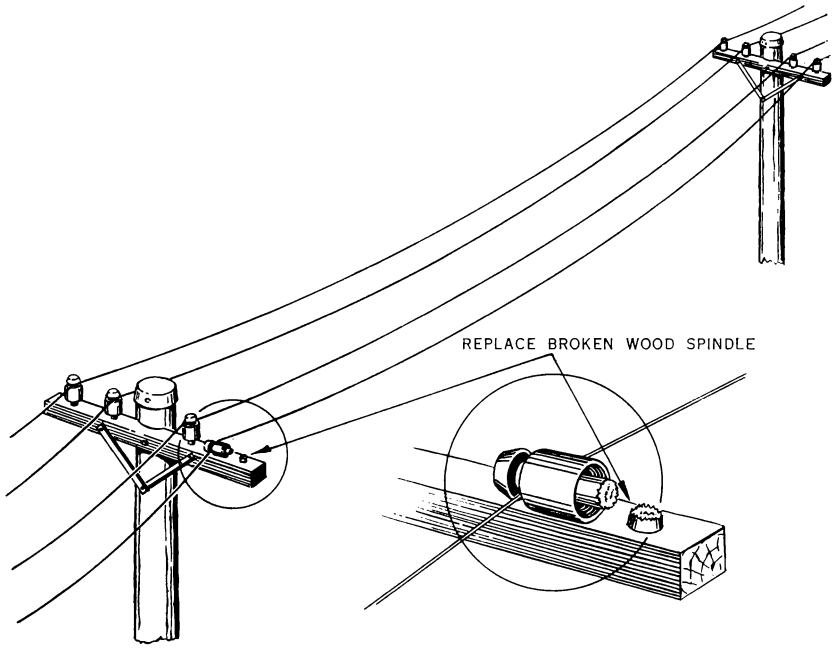
WATCH FOR THESE DEFECTS.



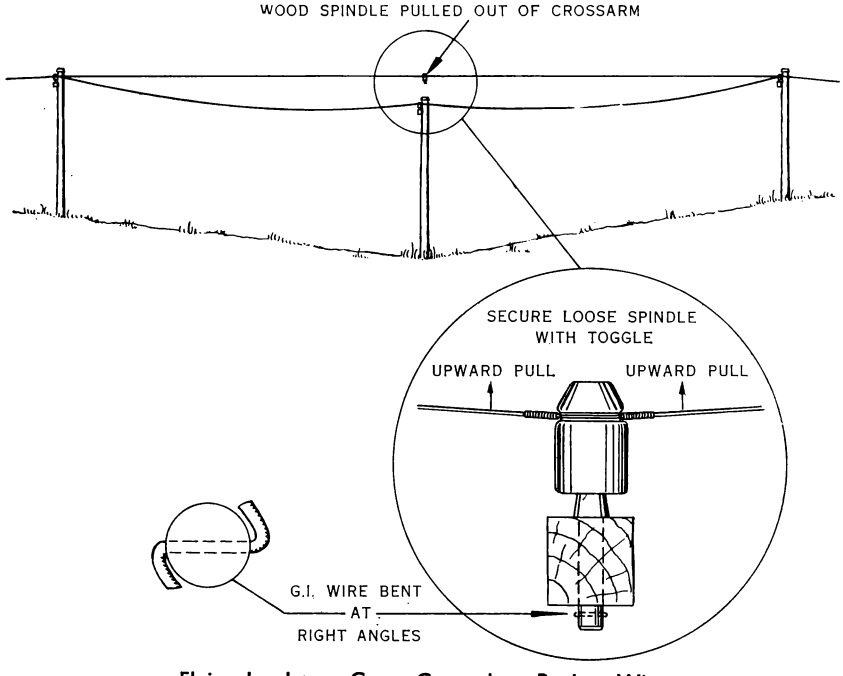
Bad Joints Cause Weak Sound and a Noisy Line.



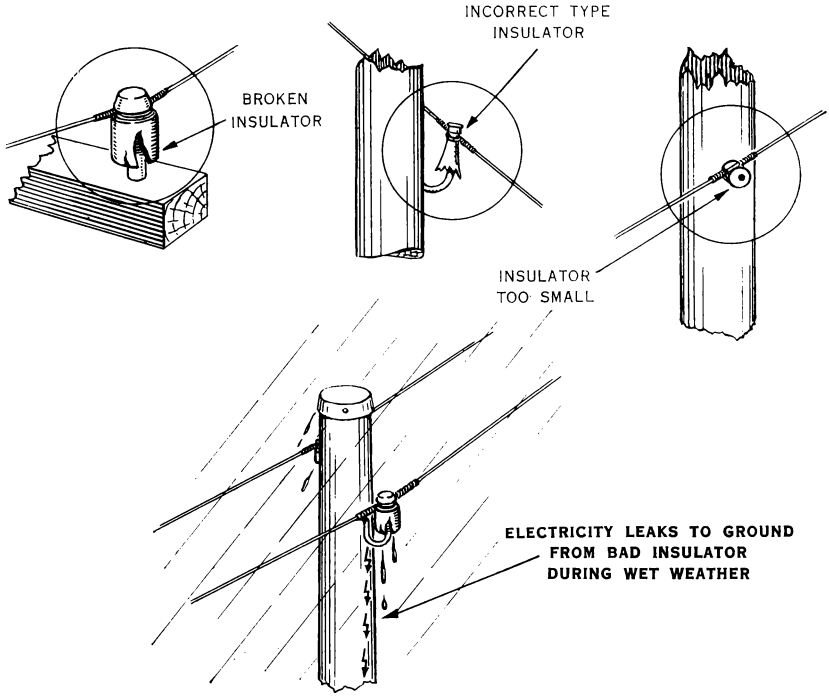
A Loose Wire Always Gives Trouble.



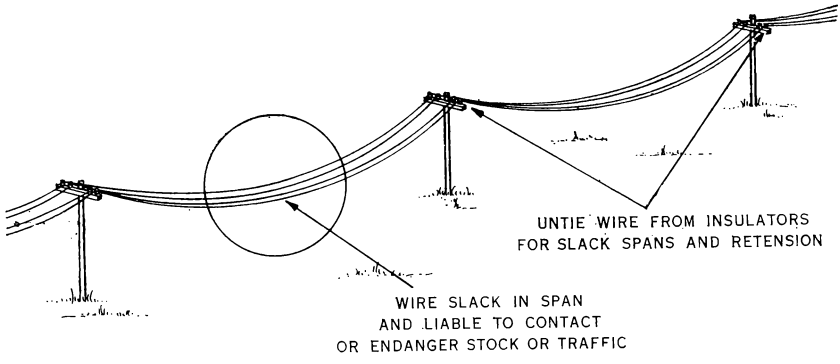
Broken Spindles Can Put Your Service and Others Out of Order.



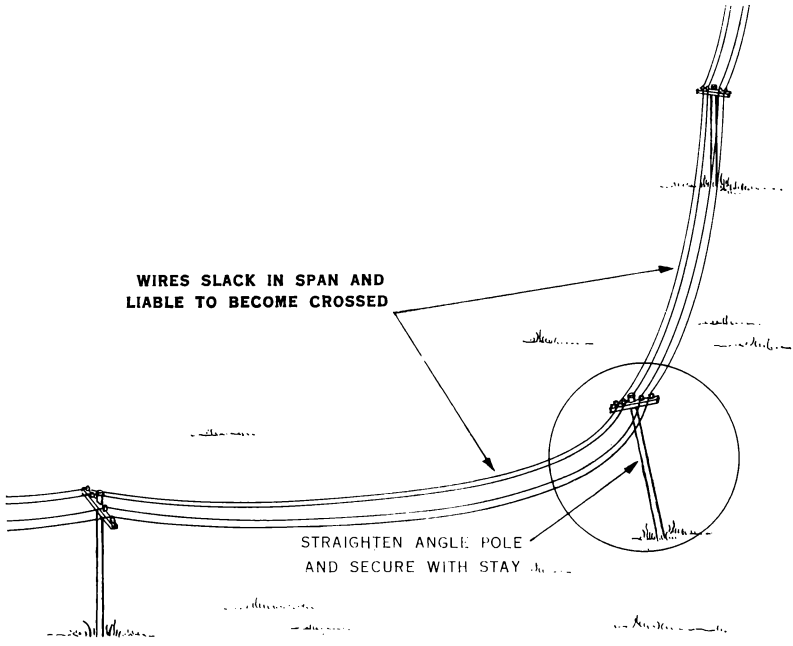
Flying Insulators Cause Crossed or Broken Wires.



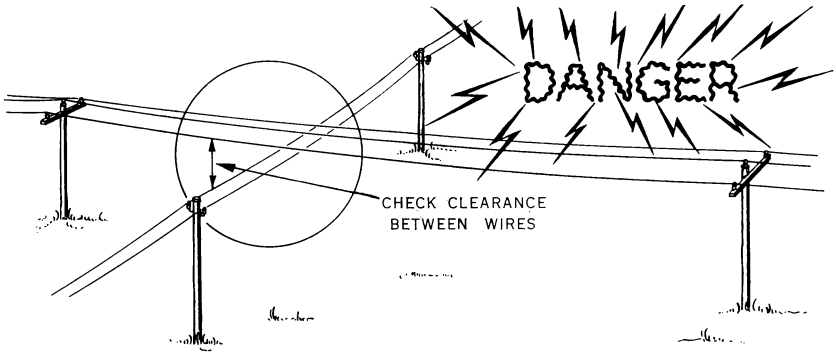
Bad Insulators Make Conversations Difficult in Wet Weather.



Slack Wires Contact Other Wires and Cause Faults.



Good Staying Keeps Angle Poles Upright.



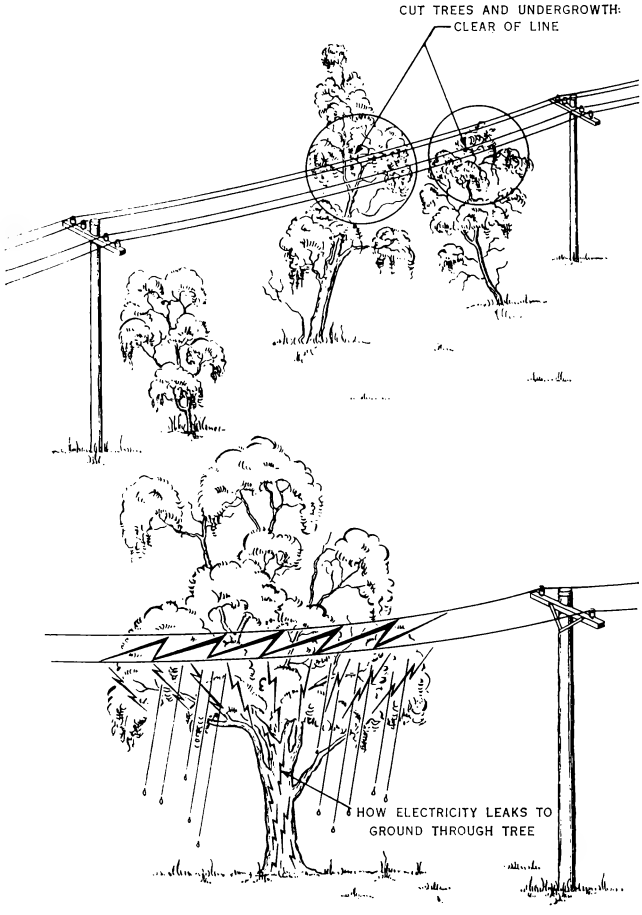
Inspect Electric Power Wire Crossings.

Check the clearance between the telephone and power wires at every electric power line crossing. If an approximate measurement by sighting leaves any doubt that the required clearance exists, request the Electricity Authority to measure the distance between the wires. Do not attempt to measure it yourself as contact with the power wires could mean death.

The minimum clearances given on page 28 must be maintained at all times.

Pay particular attention to the condition of the poles, wires and fittings on either side of the electric power crossing.

Check Clearance from Trees and Undergrowth.



Trees Touching the Wires Can Cause Noisy Lines and Faint Reception.

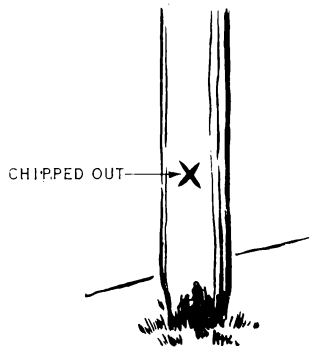
Branches of trees or even leaves touching the wire cause leakage of electricity making conversation difficult to hear in wet weather and often results in the telephone service being rendered completely unworkable. Undergrowth growing under the line is also a fire hazard and, in the event of a bushfire, the wires could be annealed and greatly weakened.

Cut the undergrowth and trees well back from the line and remove any tree limbs which are likely to fall across the wires.

HOW TO MAINTAIN WOODEN POLES

After your line has been erected for about five years, it is advisable to make a thorough examination of the wooden poles. This is necessary, both for the personal safety of yourself or any other person who may require to climb the poles, and to ensure the stability of the line. If any poles are badly decayed or eaten by white ants, or have become weakened in any other way, replace them as soon as possible. Where it is not convenient to replace a faulty pole immediately, mark it with a cross as a warning to anyone who may be attending to faults or defects on the line that the pole is dangerous to climb.

Make a further examination of the poles each year.



Condemned Pole.

Examining Poles.

Remove the soil around the pole to a depth of 1 foot.

Prod the surface of the pole below ground level with the point of a heavy knife to detect softness in the wood. If the test indicates decay, remove any decaying sapwood and test again in true wood. Check the extent of the decay and determine whether the remaining sound timber is sufficient to carry the load of the wires.

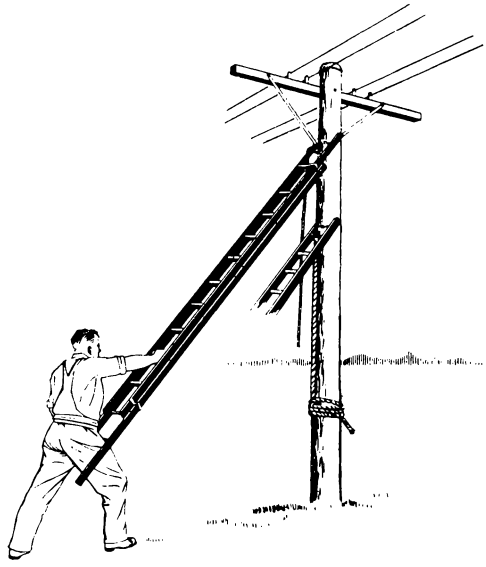
Sound the pole at several points below ground level with the back of an axe to detect hollowness. If the test indicates that the pole is hollow, bore a hole in it and check the extent of the pipe. Disregard pipes up to one-third pole diameter as these do not seriously affect the strength of the pole. Drive wooden plugs into any holes bored to prevent the entry of moisture or ants.

If you have any doubt as to the soundness of the pole, apply the " Push " or " Pull " test.

Push Test.—Place a ladder against the pole and lowest arm and try to push or swing the pole across the line of the route. If the crossarm cannot be reached, lash the head of the ladder to the pole as illustrated.

Pull Test.—Attach the centre of a rope to the pole with a slip knot (clove hitch, etc.); push the knot up the pole as high as possible and pull tight; pull on the double rope across the line of the route.

Cracking sounds will indicate the presence of internal decay.



FOR SAFETY'S SAKE ALWAYS APPLY A PUSH TEST BEFORE CLIMBING THE POLE.

Making Poles Last Longer.

Treat the poles with creosote every two years to prevent them rotting at ground level and to ward off attacks by termites.

It is usually most convenient to carry out the treatment in conjunction with the pole examination when you have removed the soil from around the poles. Cut away any decayed timber then spray or brush creosote on to the pole to about 2 feet above ground level. Puddle about ½ gallon of creosote around the pole as the soil is being replaced.

Additional treatments should be given whenever any signs of decay or white ant attack are detected.

The method of treating new poles is given on page 19.

HOW TO CLEAR FAULTS ON YOUR SERVICE

You are responsible for the clearance of faults on the private portion of your telephone line. Post Office Technical Officers will be happy to discuss any problems you may have in this regard, and explain the best methods of detecting, locating and clearing faults.

Maintenance Representative.

When two or more subscribers are connected to the exchange by a party line, one of them is chosen to be the "maintenance representative" for the line and he will be contacted by the Post Office from time to time regarding faults and repairs.

Test Calls.

It is advisable for you (or the maintenance representative in the case of party lines) to ring the exchange each morning before 9 o'clock or shortly after the opening time of the exchange. If the exchange cannot be raised on the early morning call, endeavour to localize the fault and clear it. Should it not be possible to locate and clear the fault immediately, advise the local exchange who will ring you for a special test regularly once a week and at other times when abnormal weather conditions occur such as heavy storms or floods. When the tests indicate there is a fault on the line, your service will be reported out of order.

Fault History and Guarantees.

When a fault is in evidence on a part privately maintained line, the Post Office portion will be inspected without cost to the subscriber, provided the private portion of the line has a satisfactory fault history. In this respect, you may assume that it is satisfactory unless advice to the contrary is received. If your line has an unsatisfactory fault history, you will be advised accordingly and the Post Office section of the line will not be inspected until you guarantee that, should the inspection prove the Post Office section to be clear, you will reimburse the Post Office with the actual cost of the inspection.

Full details of the guarantee procedure may be obtained from the local Postmaster or the District Telephone Officer.

Inspection of Post Office and Private Sections by Post Office Representative.

A subscriber may request that a Post Office representative should inspect the private section of the line, as well as the Post Office section to locate a fault. If the fault is located on the Post Office section, no charge is made for the inspection but if it is established that the fault is on the private section, the cost of the whole inspection will be charged against the subscriber. The officer making the inspection will point out any defects on the line which require attention and he

will clear minor faults which do not involve climbing poles. The Post Office will not undertake maintenance such as the clearing of undergrowth, replacement of poles or fittings, or retensioning wires.

Repairs to Telephone.

Should the telephone instrument itself become faulty, it will be repaired free of charge if it is delivered to the Post Office Technician. You may arrange with the local Postmaster to have the work done.

TYPICAL SERVICE TROUBLES AND THEIR CAUSES.

Cannot Raise Exchange or Other Subscribers.

The usual causes are—

Line broken (open circuit)—wire broken in span; covered lead-in wires broken at drip point, protector, or telephone; faulty fuses in protector; broken earth connection (single wire lines only).

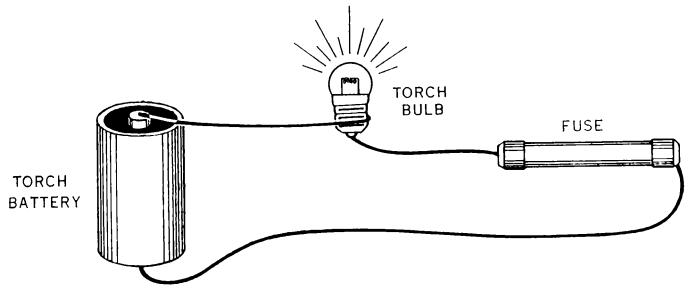
Line earthed—one wire touching ground or other earthed object such as stay wire, trees, or fence, carbon blocks in protector earthed.

Line crossed (short circuit)—line wires of double-wire line crossed in span; piece of wire across line; damaged insulation in covered lead-in wire.

Faulty telephone.

If your service is connected to a magneto exchange you may obtain an indication of the type of fault by means of the hand generator. If the generator handle is harder to turn than usual it means that the line is either crossed or earthed. If it is very easy to turn, the line is broken.

If your telephone becomes unworkable after a storm, check the protector first. Remove and clean the carbon blocks, replace any that are badly pitted, then check that the fuses have not blown. It is as well to keep a few spare fuses and carbon blocks on hand to plug in if you suspect that any have become faulty. Your local Technician will test any fuses for you, or you may test them yourself by means of a torch battery and bulb connected as shown on page 59.



Testing a Fuse.—(If bulb does not light fuse is faulty).

Noisy Line.

This may be caused by—

Faulty joints—loose, rusty or bad wire joints; loose terminals in protector or telephone; loose fuses in protector; bad earth connection (single-wire lines).

The line wire touching trees, fences, or another line.

Faulty telephone cords.

Continuous Hum on Line.

Hum is usually caused by electric currents being induced into the telephone line from electric power lines. If you experience this trouble inform the Post Office and you will be advised of the corrective measures necessary to eliminate the hum (see paragraph entitled HOW TO ELIMINATE POWER HUM).

A humming noise can also be caused by the line being earthed.

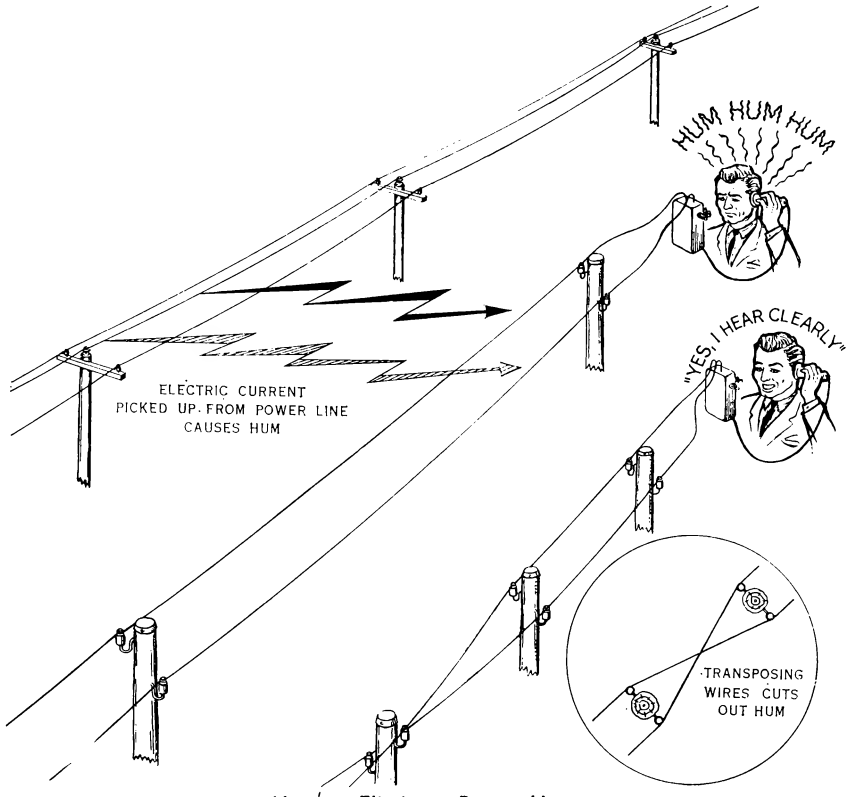
Cannot Hear Well Through Telephone or be Heard by Other Subscribers.

This may be due to—

Bad wire joints.

The line partly earthed—wire contacting trees, fences, etc., or another line; broken insulators; dirty carbon blocks in protector.

If a ring on the line temporarily improves the service the fault is almost certain to be bad wire joints.



How to Eliminate Power Hum.

Cannot Hear Other Party but Can be Heard by Them.

If this is experienced on all calls the trouble is likely to be in your telephone and you should forward it to the Post Office Technician for repairs.

Can Hear Others but Cannot be Heard by Them.

If the service is connected to a magneto exchange, check the conditions of the telephone batteries and the battery wiring. If the batteries are faulty, arrange with the Postmaster or Technician for replacements to be supplied.

If new telephone batteries do not correct the trouble or if the service is connected to an automatic or semi-automatic exchange, the fault is likely to be in the telephone and it should be forwarded to the Technician for repairs.

Other Conversations Can be Heard on Line.

This is known as crosstalk and results from either a wire of your line touching a wire of another service or earth, or your line picking up electric current from another line through the air or the ground.

Crosstalk on double-wire lines caused by electrical interference from nearby lines can be eliminated by inserting transpositions or crossovers in the wires, i.e., reversing the positions of the wires on the poles at intervals along the route.

If you experience crosstalk on your service, forward a parish map or sketch plan drawn approximately to scale to the Post Office showing the route of your line and the other private lines in the vicinity so that you may be advised of the action necessary to rectify the trouble. It will assist if you can identify the offending service.

Double-wire Lines.

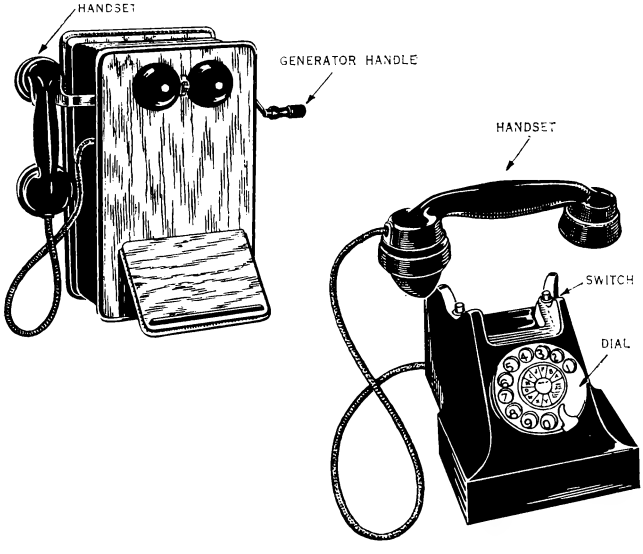
Power hum can be greatly reduced by the insertion of transpositions or crossovers in the wires along the portion of the route exposed to interference from the power lines. Forward a parish map or plan drawn approximately to scale to the Post Office showing the relative positions of the power route and your line, so that you may be advised where to fit the transpositions. The methods of installing transpositions are shown on pages 36 and 37.

Single-wire Lines.

This type of line is more subject to interference from power lines than the double-wire line. Where the hum is severe, it will be necessary to shift the line beyond the range of the interference or to erect a double-wire line on all or portion of the route and then transpose the wires to prevent interference.

The Post Office will advise you on the modifications required to your telephone line if you forward a parish map or sketch plan showing the relative positions of your line and the power lines.

SIMPLE TESTS FOR TELEPHONES.



If you suspect that the telephone instrument is faulty carry out the following tests:—

Magneto Telephones (fitted with generator handle)—

Disconnect the line wires at the telephone or terminal block. The generator handle should then turn very freely and spring back slightly when released.

Connect a short length of bare wire between the two-line terminals at the telephone or terminal block—

(*a*) The generator handle should now be much harder to turn and should move jerkily.

(*b*) Blow into the mouthpiece while listening to the receiver. A strong sound should be heard. If the sound is weak or cannot be heard, check the batteries.

Make sure when the handset or receiver is lifted that the switch on which it rests lifts freely.

Examine the telephone cords for signs of damage. Hold the receiver to your ear and shake the cords. If scratching or crackling noises are heard the cord is faulty.

Automatic Telephones (fitted with dial) and Central Battery Telephones (not fitted with dial or hand generator)—

It is usually beyond the scope of a subscriber to carry out detailed tests on these telephones but the following checks can be made:—

Make sure that the switch lifts freely when the receiver or handset is removed.

On automatic telephones check that the dial turns freely and returns to the normal position when a number is dialled.

If any of the tests indicate that the telephone is faulty take it to the Post Office Technician for repairs. Do not attempt to locate the fault within the telephone or effect repairs yourself. This is a job for an expert and will be carried out by the Post Office free of charge.

A. C. Brooks, Government Printer, Melbourne.